AMERICAN MACHINIST

November 1, 1939

Tool Control—*Dravo's method for controlling small tools used throughout the plant includes a written record of each tool crib transaction. For details see page 908*

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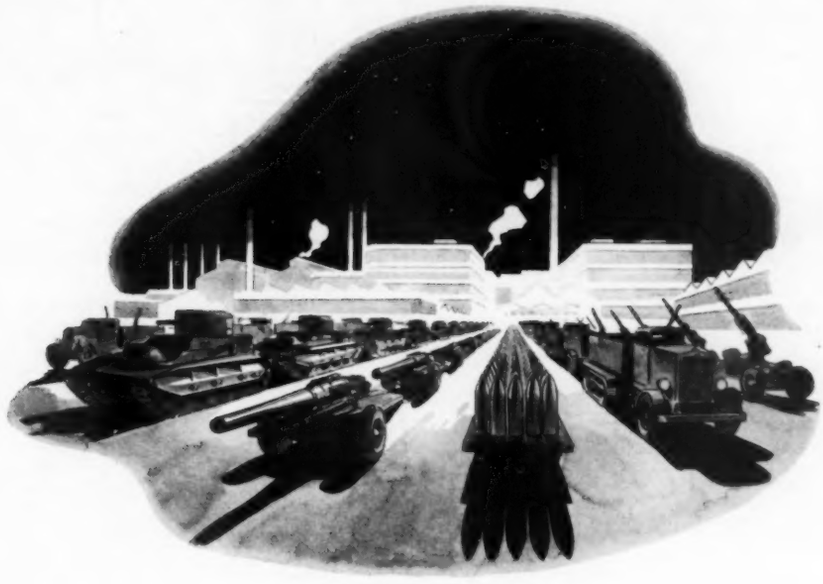
ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor



M-Day---1939 Version

The War Department has revised its 1936 plan for industrial mobilization, but hasn't given the new set-up much publicity. Here is the program in case of war

PLANS FOR M-day are no secret. Industry in the United States is to be mobilized for war service as quickly as possible should that unhappy day ever come. The War Department has prepared for that event and has publicized widely its 1936 program of what would happen then.

More recently the plan has been revised. Not much is being said or written about the 1939 version, partly because the American people are determined to keep out of the present European conflict.

But, after all, the national effort to provide a workable industrial mobilization program isn't jingoism. It isn't tied in with war-mongering. It is a sane and sensible way of furthering national defense by being prepared—just in case. Now, more than ever before, tremendous productive resources must stand behind every man with a gun. And those resources, developed for peacetime purposes, must be capable of speedy transition to wartime use. The 1939 industrial mobilization plan has been developed to achieve this result.

Since civilian leaders must necessarily administer the plan under conditions which cannot be exactly predicted, it has been made as flexible as possible. Its essential parts, however, are clearly outlined to define relationships among the various proposed agencies.

Some form of guidance would be needed to change the country over rapidly to a wartime economy. Various measures would have to be taken to mobilize and utilize effectively the nation's materials, capital, labor, power, fuel, and transportation and communication facilities. The sole purpose in supervising the use of national resources would be to assure effective support of the armed forces while protecting industry and the civilian population from unnecessary inconvenience.

Coordination would be promoted by the following important measures:

PRIORITY, whereby precedence is established in the procurement program after considering all the nation's urgent needs. In the last war priority soon became the most powerful and important single means of directing resources into desired production channels. Methods of applying it may take any of the following forms:

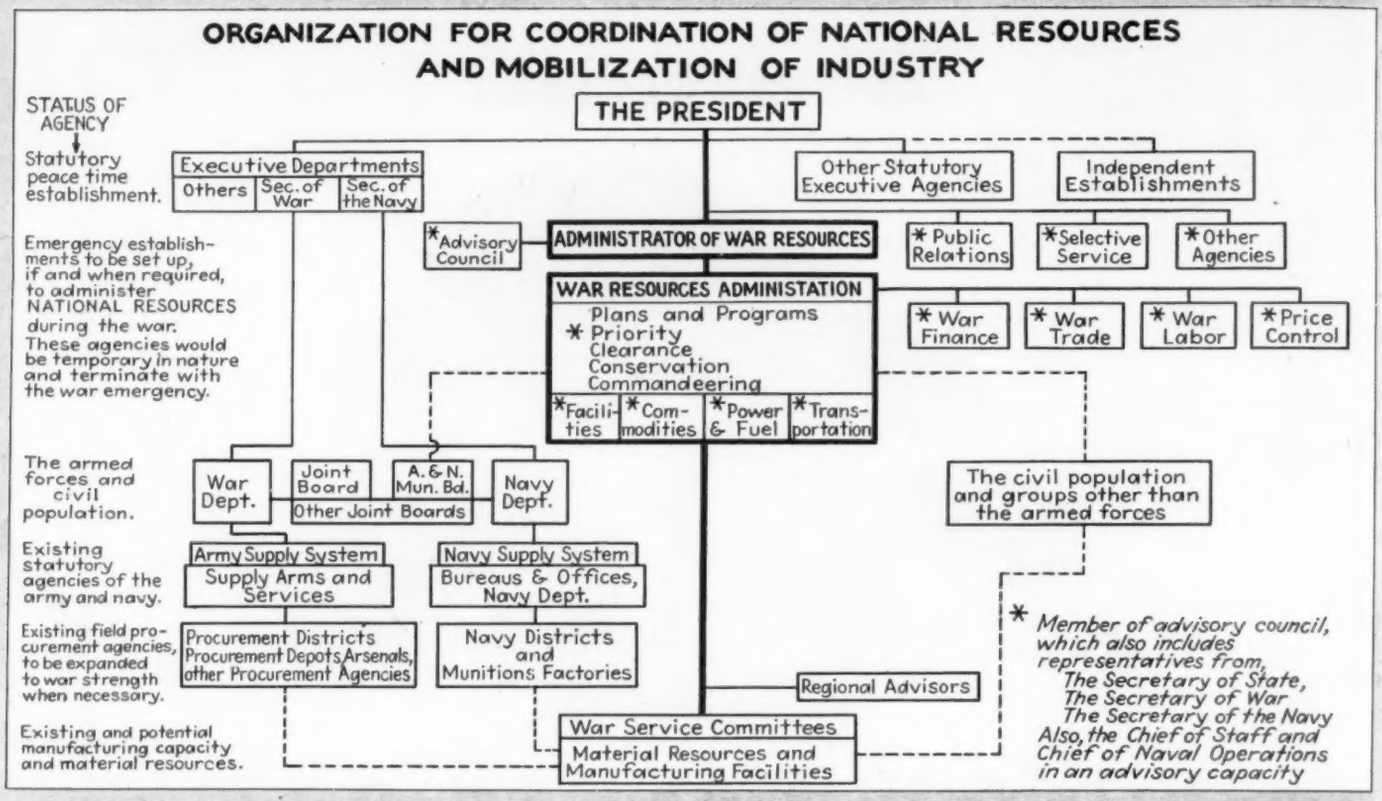
Classification Ratings, to determine the order in which resources are to be used. *Allocations,* which assign the productive capacity of individual plants to specific agencies. *Licenses, Embargoes, Permits and Warrants,* set up to establish precedence in utilization of resources.

CONTROL OF PRICES, which may be required to minimize disruption of the national economic structure resulting from the rapid increase in demand.

CONTROL OF FOREIGN TRADE, to

MORE CHANGES PLANNED

As we go to press, the War Resources Board is reported to have recommended still further changes in the industrial mobilization plan. These changes may soon be made public by the President.


ORGANIZATION FOR COORDINATION OF NATIONAL RESOURCES AND MOBILIZATION OF INDUSTRY
STATUS OF AGENCY
THE PRESIDENT
Statutory peace time establishment.
Executive Departments
Others
Sec. of War
Sec. of the Navy
Other Statutory Executive Agencies
Independent Establishments
Emergency establishments to be set up, if and when required, to administer NATIONAL RESOURCES during the war. These agencies would be temporary in nature and terminate with the war emergency.
*Advisory Council
ADMINISTRATOR OF WAR RESOURCES
* Public Relations
*Selective Service
*Other Agencies
WAR RESOURCES ADMINISTRATION
Plans and Programs
* Priority
Clearance
Conservation
Commandeering
*War Finance
*War Trade
*War Labor
*Price Control
*Facilities
*Commodities
*Power & Fuel
*Transportation
The armed forces and civil population.
War Dept.
Joint Board
Other Joint Boards
A. & N. Mun. Bd.
Navy Dept.
The civil population and groups other than the armed forces
Existing statutory agencies of the army and navy.
Army Supply System
Supply Arms and Services
Navy Supply System
Bureaus & Offices, Navy Dept.
Existing field procurement agencies, to be expanded to war strength when necessary.
Procurement Districts
Procurement Depots Arsenals, other Procurement Agencies
Navy Districts and Munitions Factories
Regional Advisors
* Member of advisory council, which also includes representatives from, The Secretary of State, The Secretary of War The Secretary of the Navy Also, the Chief of Staff and Chief of Naval Operations in an advisory capacity
Existing and potential manufacturing capacity and material resources.
War Service Committees
Material Resources and Manufacturing Facilities

Keystone of the latest plan proposed for industrial mobilization would be the War Resources Administration, to be set up in skeleton form as soon as an emergency is envisaged. It would coordinate all economic functions to assure effective support of the armed forces while protecting industry and the civilian population from unnecessary inconvenience

include licensing of importers and exporters, negotiation of trade agreements with neutrals, and furtherance of the economic isolation of the enemy.

ORGANIZATION OF GOVERNMENT CORPORATIONS, which might become necessary to render services or take business risks which it would be unreasonable to expect from privately-owned corporations.

Organizational Plans

To carry out effectively the coordinating measures just outlined, it is proposed that when war is imminent and without waiting for serious economic problems to develop, the direction of utilization of the country's national resources should be taken over immediately by the government through an organization manned by qualified citizens chosen by the President.

The accompanying chart shows the agencies through which the President would exercise those essential wartime functions peculiar to his office. It will be noted that these agencies are not existing governmental bureaus, but are new, independent and temporary. Heart of the plan is the War Resources Administration.

All economic functions in time of war would be interrelated and interdependent. It is therefore highly important that one major agency be created to coordinate the performance of these functions, and that other agencies be set up only as the necessity arises, to supplement the work of the key agency. It is considered highly desirable that this key agency be the War Resources Administration.

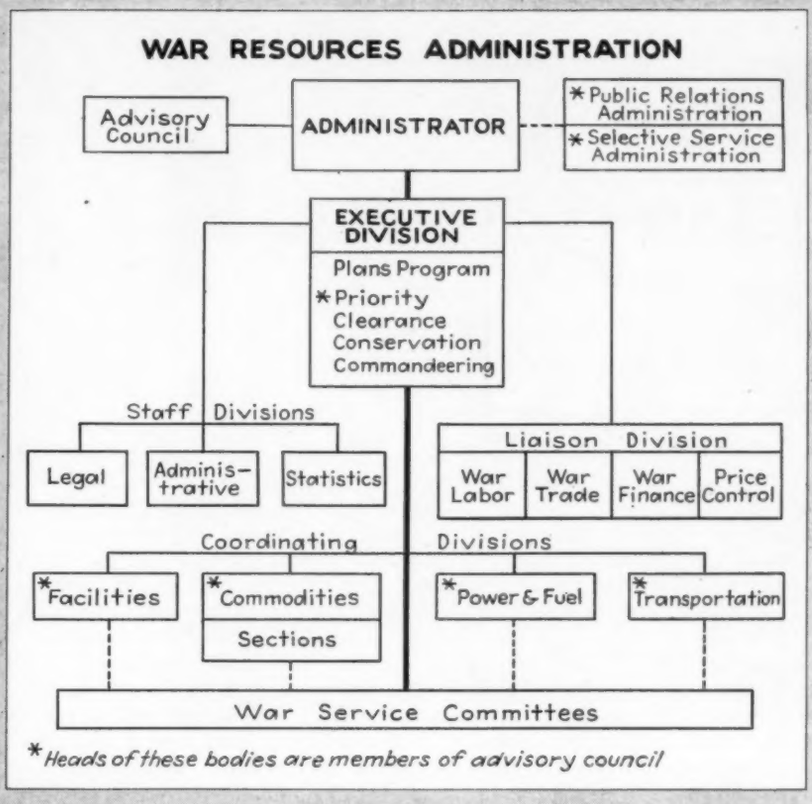
This Administration would be set up in skeleton form as early as practicable when an emergency is foreseen. If its creation is delayed, the Army and Navy Munitions Board would assume the responsibility for guidance during the transition period. Peacetime procedure would be modified only when it failed to meet the requirements of the situation. Any changes would be designed to distribute the war load as equitably as possible and to minimize the difficulties of post-war adjustment. Reduction of activities of non-essential industries or partial conversion to more useful purposes may be considered necessary.

General organization of the War Resources Administration is shown in the second chart. Divisions indicated provide points of contact between the coordinating agency and the various economic elements for which control may be necessary. Inclusion of all these divisions in the chart does not necessarily mean that all the controls indicated would be required. But these divisions help in planning, so that if required definite action may be taken without delay.

Powers and responsibilities of the War Resources Administration would be vested in an Administrator, appointed by and responsible to the President. Assisted by an Advisory Council, he would formulate the basic policies of industrial mobilization. This Advisory Council would be composed of the heads of the coordinating divisions of the War Resources Administration, representatives of any other superagencies which may be created, and representatives of the State, War and Navy Departments.

Coordinating Divisions

The Executive Division would be the office for study and coordination of general economic plans and programs, including those relating to priority, price control, clearance, conservation and post-war readjustment. It would be assisted by staff divisions including the Administrative, Legal, Statistics and Liaison Divisions.



Divisions of the War Resources Administration would provide points of contact between the coordinating agency and the various economic elements for which control may be necessary. Some might not be needed

Coordinating Divisions would be concerned with specific and harmonious application of the broad policies of the Administration. They would be concerned primarily with approved policies and priorities within their respective fields, while at the same time recognizing established procuring agencies and allowing them the greatest possible freedom in the discharge of procurement responsibilities. Staffs of all coordinating divisions would include trained personnel from both the War and Navy Departments. Each division would necessarily maintain liaison with other governmental agencies, with trade associations and with engineering, professional and scientific societies. The total would include at least the following divisions:

FACILITIES. Primary mission of this division would be assistance in meeting national requirements in those cases where existing productive capacity is inadequate to meet anticipated demands, through application of priorities and direction of extension, conversion and construction of facilities. Existing power, labor and transportation facilities would be used wherever practicable to fill war orders, thus promoting rapid and efficient production. Primary means of application of basic priorities within this division would be allocation of facilities to procurement agencies rather than assignment of war orders to facilities.

COMMODITIES. This division, through the Commodity Sections into which it would be subdivided, would be concerned with assuring availability of materials indispensable to production essential to meet the requirements of the armed forces and civilian population.

POWER AND FUEL. Purpose of this division would be to insure an adequate supply of fuel and power to facilities essential to war production, while giving due consideration to essential civilian requirements. To accomplish this it may initiate measures governing use, conservation and development of sources of supply. It would cooperate with existing bodies in removing peacetime restrictions impeding war production. Measures set up by this division may be executed by established agencies or by the division itself.

TRANSPORTATION. This division would be concerned with coordination of all interior transportation in accordance with basic priority policies. Necessary measures would be administered by established federal regulatory bodies, with the assistance of the appropriate War Service Committees.

Other Emergency Administrations

Other administrations for coordinating various phases of the national economy may be organized as required. These might include:

PUBLIC RELATIONS, which would present to the public information concerning the purposes, views and progress of the government in the prosecution of the war.

SELECTIVE SERVICE, whose general mission would be the selection of personnel for, and their induction into, the armed services.

WAR FINANCE, to advise the President on the financial policies appropriate to governmental and private needs. In time of war, functions to be carried out under policies approved by this group would be identical in nature to those now performed by such existing agencies as the Treasury Department, Federal Reserve Board, Reconstruction Finance Corporation, Securities Exchange Commission and Export-Import Bank. Actual administration of these functions would be left in the hands of existing agencies.

WAR TRADE, which would regulate imports and exports to further the economic interests of the United States and to damage those of the enemy. If controls proved necessary, these would include export and import licenses, reciprocity, and trade negotiations with other countries.

WAR LABOR, which would provide machinery for equitable and voluntary distribution of labor to industry and agriculture by maintaining close cooperative relations between labor, industry and the government. Labor requirements would be determined for war and non-war industries, with primary atention devoted to furnishing adequate labor supplies for the more important industries, thus keeping the job and the worker together as far as circumstances permit.

PRICE CONTROL, to keep prices within reason should all other measures fail.

War Service Committees

War service committees are proposed as valuable points of contact between industry and emergency coordinating agencies. They would be composed of trusted representatives of their respective industries working with, but not designated officially as a part of, any emergency agency.

Rifle Parts—Broached

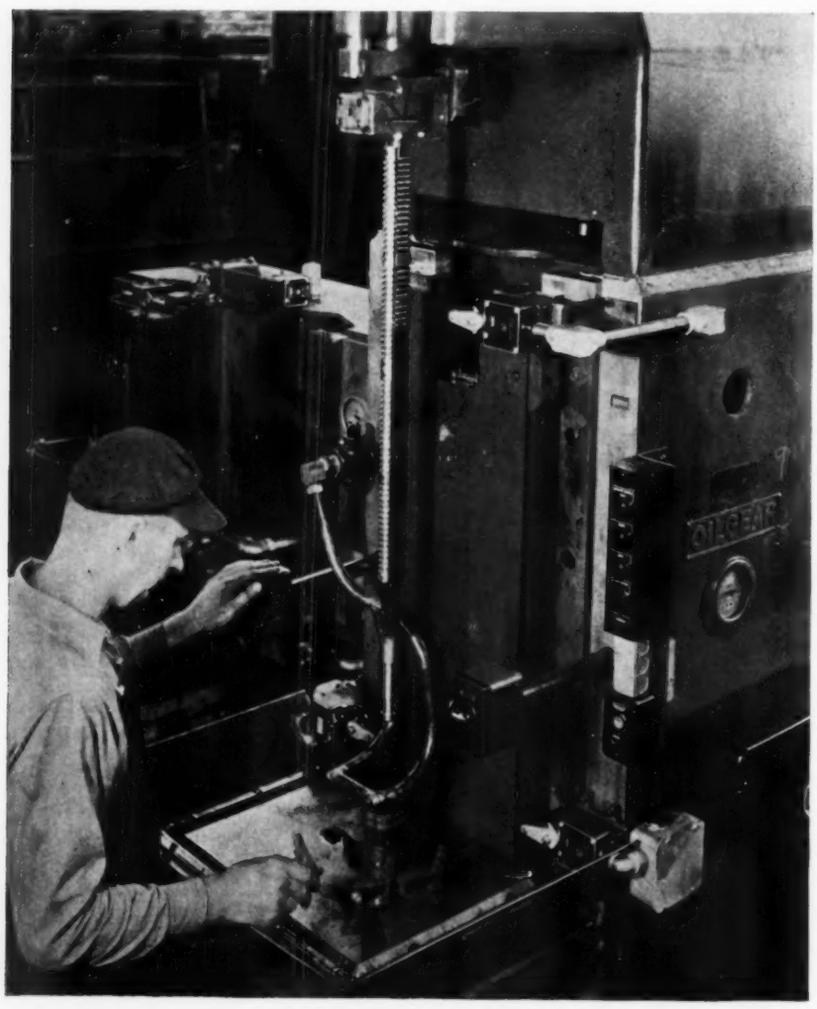
Case studies of rifle manufacture prove the value of broaching in high-speed production of trigger guards and sight bases.

CASE STUDIES made during the past year on the mass production of army rifles will result in producing them faster than otherwise would have been possible. Some of these studies have indicated the possibilities of adapting broaching methods to the manufacture of sight bases, trigger guards and miscellaneous internal parts, for which purpose a group of 26 standard vertical, internal and external broaching units were installed in one ordnance factory. These are single-slide vertical surface, double-slide vertical surface, and vertical pull-down Oilgear machines equipped with tools and fixtures by the Detroit Broach Company. Here are the manufacturing details.

All internal surfaces are broached on vertical pull-down machines. They are equipped with automatic tool handling; dual pushbutton control with selector switch for manual, semi-cycle or semi-automatic operation; automatic puller operation; and variable broaching and return speeds. No clamping, threading of work over tool shank, handling of tool puller keys or complex fixture is necessary. Parts are merely laid on the simple fixture and roughly located, the tool centralizing the part before broaching.

External surfaces are broached on single- and double-slide vertical surface machines. They have a selector switch for manual, semi-automatic and full-automatic operation; automatic, straight in and out shuttle-table operation interlocked with tool-slide operation; micrometer stops for precise positioning of the shuttle table and work in broaching position; automatic clamping and unclamping of work; and variable broaching and return speeds.

Since several of the rifle parts are broached both internally and externally, we shall first illustrate and describe the sequence of these operations and the machines, tools and fixtures used. Other rifle parts on which only one broaching operation is performed will be described in a later number.

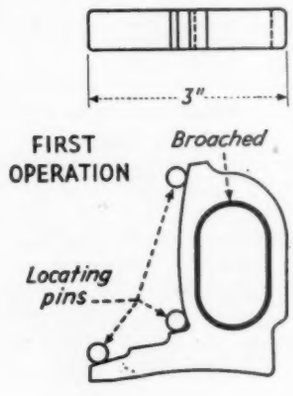


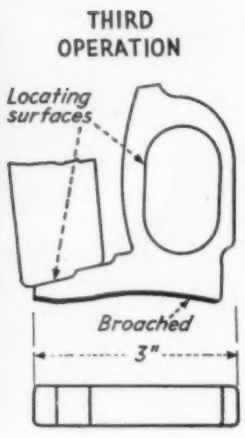
TRIGGER GUARD

(With parallel side surfaces)

FIRST OPERATION

MATERIAL: Forged carbon steel.
OPERATION: Finish broach inter-





nal oval hole $1\frac{5}{32}$ in. wide by $2\frac{1}{32}$ in. long from a rough pierced hole. Broach two parts per stroke.

STOCK REMOVED: 0.067 in. maximum on each side.

PRODUCTION: 500 per hr.

TOOL: Built-up type with solid bar for straight surfaces and sectional inserts for both half-rounds.

FIXTURE: Simple faceplate type with three pins for roughly locating part.

MACHINE: Vertical pull-down broaching machine, 12x30-in. stroke.

CYCLE: Operator roughly locates two parts on the fixture and depresses dual safety control buttons. Tool threads through work, enters puller and is automatically pulled down to broach parts. Finished parts are removed and dual safety control is depressed to return tool-slide and tool to loading position. Operator does not handle tool. Cutting speed, 30 ft. per min. Return speed, 80 ft. per min.

SECOND OPERATION

(Left-hand shuttle table and tool-slide only.)

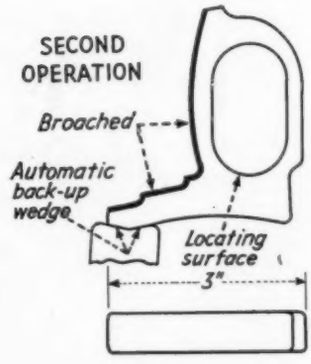
MATERIAL: Forged carbon steel.

OPERATION: Finish broach a 12-in. radius and three step surfaces from the rough forging. Broach two parts per stroke.

STOCK REMOVED: 0.080 in. on each surface.

PRODUCTION: 460 per hr.

TOOLS: Sectional type. Individual sections for radius and flats. Two sets of tools are mounted on left-hand slide and staggered to reduce broaching force.



FIXTURE: Automatic dual-jaw type with spring-loaded wedges for automatically clamping and unclamping parts as shuttle table moves into broaching position and out to loading position.

MACHINE: Double-slide vertical-surface broaching machine, 12x30-in. stroke.

CYCLE: Operator locates the broached oval hole in parts over pins and depresses dual safety control buttons. Shuttle table moves in to broaching position as spring-loaded wedges backup parts and jaws clamp parts in place. Tool-slide automatically moves down to broach parts and stops. In the meantime, the operator is unloading and loading the parts in the right-hand shuttle table fixtures where the third or final operation is performed on the same parts. Cutting and return speeds are 30 ft. per min.

THIRD OPERATION

(Right-hand shuttle table and tool-slide only.)

MATERIAL: Forged carbon steel.

OPERATION: Finish broach a 5-in. radius and two angular flats from the rough forging. Broach two parts per stroke.

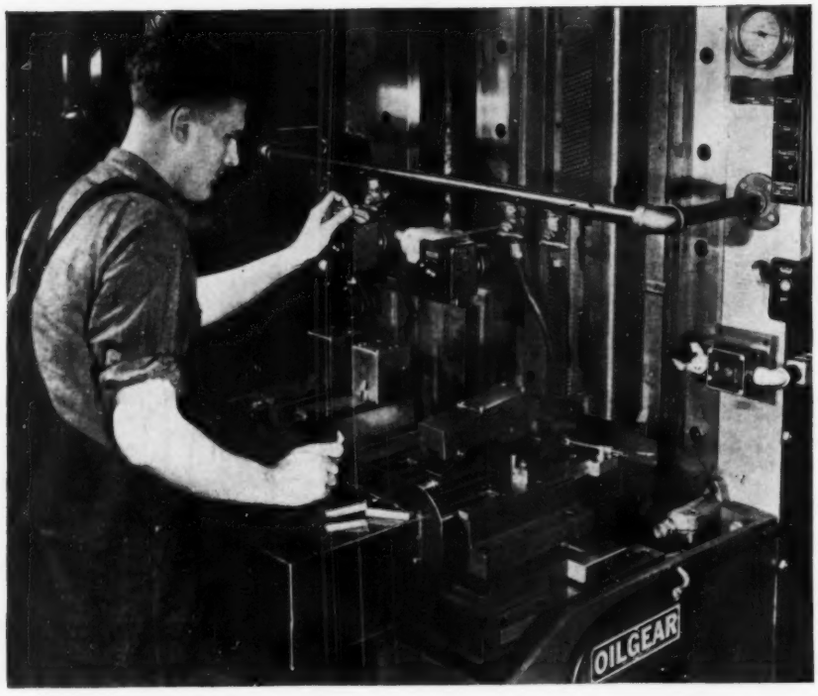
STOCK REMOVED: 0.080 in. on each surface.

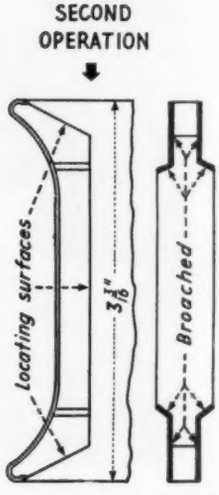
PRODUCTION: 460 per hr.

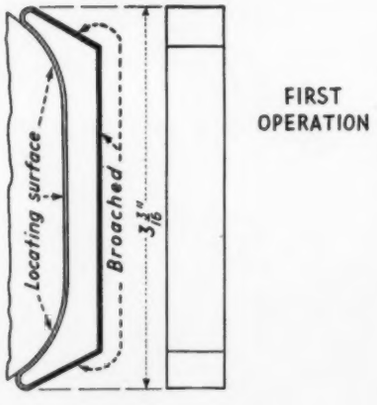
TOOLS: Sectional type. Individual sections for radius and flats. Two sets of tools are mounted on right-hand slide and staggered to reduce broaching force. Automatic dual-jaw type with spring-loaded wedges for automatically clamping and unclamping parts as shuttle table moves into broaching position and out to loading position.

MACHINE: Double-slide vertical-surface broaching machine, 12x30-in. stroke.

CYCLE: Operator locates the broached oval hole in parts over pins and broached step surfaces against a locating pin and depresses dual safety control buttons. Shuttle table moves into broaching position and jaws clamp parts in place. Tool-slide automatically moves down to broach parts and stops. In the meantime the operator is unloading and loading the parts in the left-hand shuttle table fixtures where the second or preceding operations are performed on the rifle trigger guards. Thus, sequent operations are performed. Cutting and return speeds are 30 ft. per min.







FIRST
OPERATION

RIFLE PART

FIRST OPERATION

MATERIAL: Forged carbon steel.

OPERATION: Finish broach a $\frac{15}{32}$-in. by $2\frac{3}{4}$-in. straight surface and a $\frac{15}{32}$-in. by $\frac{3}{4}$-in. angular surface on each end of two rifle parts per stroke.

STOCK REMOVED: 0.100 in. maximum on each side.

PRODUCTION: 460 per hr.

TOOL: Sectional sweep type for each surface broached and mounted in a convenient holder.

FIXTURE: Automatic jaw and finger type with spring-loaded wedges for locating parts prior to clamping. Parts are automatically clamped and unclamped as shuttle table moves in to broaching position and out to loading position.

MACHINE: Double-slide vertical-surface broaching machine, 12x30-in. stroke.

CYCLE: Operator roughly stacks two parts in fixture and depresses dual safety control buttons. Shuttle table moves in to broaching position and spring-loaded fingers locate parts as a jaw clamps them in place. Tool-slide automatically moves down to broach parts and stops. In the meantime operator is unloading and loading the parts in the left-hand shuttle table fixture where the second operation is performed on the same parts. Cutting speed, 30 ft. per min.

SECOND OPERATION

MATERIAL: Forged carbon steel.

OPERATION: Finish broach two surfaces on each side of two rifle parts per stroke. (Eight surfaces in all are broached.)

STOCK REMOVED: 0.070 in. from each surface.

PRODUCTION: 460 per hr.

TOOL: Sectional sweep type for each surface broached and mounted in two convenient holders.

FIXTURE: Automatic jaw type with concealed spring-loaded wedges for clamping and unclamping parts as shuttle table moves in to broaching position and out to loading position.

MACHINE: Double-slide vertical-surface broaching machine, 12x30-in. stroke.

CYCLE: Operator roughly locates each part, on the three surfaces previ-

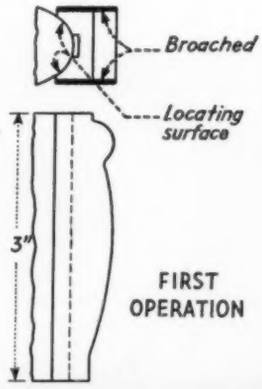
ously broached, in separate fixture receivers and depresses dual safety control buttons. Shuttle table moves in to broaching position and short jaws locate and clamp parts in place. Tool-slide automatically moves down to broach parts and stops. In the meantime operator is unloading and loading the parts in the right-hand shuttle table fixture where the first operation is performed. Cutting and return speeds are 30 ft. per min.

RIFLE SIGHT BASE

FIRST OPERATION

MATERIAL: Forged carbon steel.

OPERATION: Finish broach both side surfaces $\frac{3}{4}$ in. wide by 3 in. long on two parts per stroke.



STOCK REMOVED: 0.100 in. maximum per side.

PRODUCTION: 500 per hr.

TOOL: Sweep type, individual bars.

FIXTURE: Automatic jaw and self-locating type. Spring-loaded lever mechanism clamps and unclamps parts as shuttle table moves to and from the broaching position.

MACHINE: 20x30-in. stroke, single-slide vertical broaching machine.

CYCLE: Operator places a rough part in each fixture and depresses the dual safety control buttons. Shuttle table moves in to broaching position and jaws automatically locate and clamp parts in place. Tool-slide automatically moves down to broach parts and stops. Shuttle table moves out to loading position and parts are automatically unclamped. Tool-slide rises to starting position and stops. The cycle is semi-automatic. Cutting speed, 30 ft. per min. Return speed, 80 ft. per min.

SECOND OPERATION

MATERIAL: Forged carbon steel.

OPERATION: Finish broach a special contour $\frac{3}{4}$ in. wide by 3 in. long on two parts per stroke. Maximum tolerance 0.002 in. in increments of $\frac{1}{16}$ in. on contour.

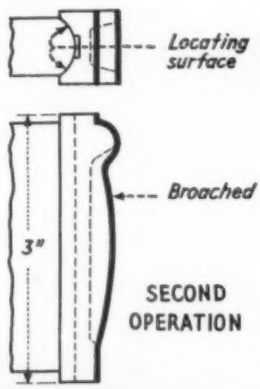
STOCK REMOVED: 0.100 to 0.250 in. maximum.

PRODUCTION: 500 per hr.

FIXTURE: Automatic dual-jaw type with spring-loaded wedges for clamping and unclamping parts as shuttle table moves in to broaching position and out to loading position.

MACHINE: Single-slide vertical broaching machine, 12x42-in. stroke

CYCLE: Operator roughly locates two parts in the fixture and depresses the dual safety control buttons. Shuttle table moves in to broaching position as tapered side guides accurately locate bases in position before the clamps grip parts in place. Tool-slide automatically moves down to broach parts and stops. Shuttle table moves out to loading position and parts are automatically unclamped. Tool-slide rises to starting position. The cycle is semi-automatic. Cutting speed, 30 ft. per min. Return speed, 80 ft. per min.



Study Step Welds For Profit

Here is a logical analysis of reducing the cost of step welding by separating arc, set-up and unaccounted-for time

By E. W. P. SMITH
Consulting Engineer
The Lincoln Electric Company

HOW CAN COST, or time, be separated into various component parts when making a study of step welding? Attempts to obtain the actual arc-operating time with a stop watch is a long drawn-out procedure. It is better to devise a systematic study based on the time the arc is not in operation; then the various items involved in such idle time can be given adequate consideration.

To do this, the unit of measurement should be the overall cost of a foot of weld. This consists of the total-time cost which is made up of the cost of the actual arc time, the time for setting up the work, plus unaccounted time.

Analysis of Cost Factors

To say that a reduction in cost may be obtained easily by simply reducing the total time may seem to be a somewhat trite statement. Reduction of time may be easy to accomplish, but because of the fact that the factors responsible for the cost are not readily known, and because the intervals of time during which the cost factors occur are not known, this is not as simple as it might seem. The only solution to the problem is a careful analysis of the total time.

In making the analysis, the three factors previously referred to, that is, the actual arc time, the set-up time, and the time which is unaccounted for, must be given consideration. But, until the values for each of these three components are known, they will not permit analysis.

Take, as an example, a job on which there is 12 ft. of welding, consisting of both step and tack welds. The time for doing the job, that is, the floor-to-floor time, is 9 hours, or 1.33 ft. per hr. This figure is exceedingly low, considering the type of joint and various other factors. Therefore, the problem is one of finding which of the three components of the total time may be responsible for the condition.

There is an extremely simple method by which the total arc time can be found. The overall welding time, that is, the time the operator is actually applying weld metal can, of course, be readily ascertained. Consideration is given to the type and size of electrode which the operator uses, the welding current, and the stub ends of electrodes.

The type and size of electrode used for the job and also the current used for the welding are known to the supervisor. The footage of electrode used during the time the arc was in operation would be the total length

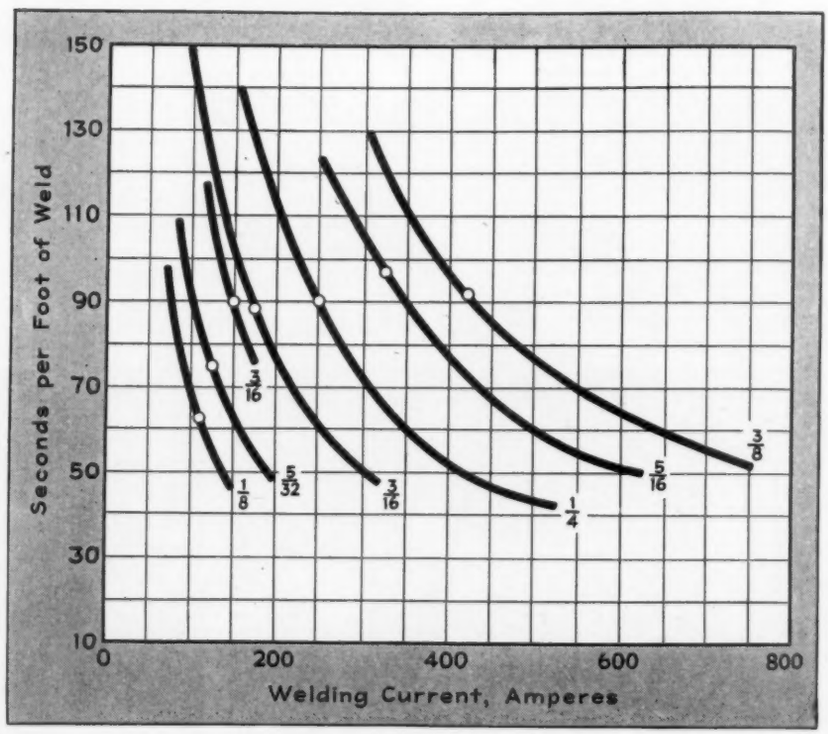


Fig. 1—These are the deposit rates of various electrodes at different welding currents. The current recommended for each electrode is indicatd by the circle on each curve

of the electrodes minus the total length of the stub ends returned by the welder.

The consumption rate of the electrode may be obtained easily by reference to a curve such as that shown in Fig. 1, which covers the size of the electrode and the current used. The consumption rate for a $\frac{3}{16}$-in. electrode and larger is about 90 sec. per ft. at normal current. For other currents, the rate of consumption is in proportion to current. This is evident from the chart.

Application of the Study

An example can be worked out, using the figures previously given, that is, 12 ft. of welding and 9 hr. total time. The total time to weld has been determined and this has been found to be 3 hr., leaving 6 hr. for set-up and other time which is unaccounted for. Upon this basis, the rate of production is 4 ft. of welding per hour. This figure is not to be compared with usual arc speed for a straight run because in the case under consideration the work consists of intermittent tacking with consequent interruptions.

Consideration of our problem indicates that a rate of 4 ft. of weld per hour is not satisfactory. Obviously, some interference is slowing up the production.

To do the work, the operator was issued 13 electrodes of which the 13 stub ends were returned, as shown in Fig. 2. The total length of the electrode, each being 14 in. would therefore be 13 x 14 or 182 in. If the length of the stub ends returned were 38 in., 144 in. or 12 ft. of electrode would have been used in depositing weld metal.

Referring to Fig. 1, we can figure it would take 18 min. of actual operation of the welding arc to deposit the 12 ft. of metal at the consumption rate of 90 sec. per ft. This indicates that only 18 min. of the 3 hr. was consumed by the actual welding operation. Therefore, it is evident that fitting up the work, interruptions and other factors account for a great deal of time required for completing the work outlined.

The actual welding time having been determined, it is now possible to direct the attention to two factors. First, the footage of weld compared with the actual arc time to determine the actual arc speed rate, which in this case, is 40 ft. per hr. Second, the time for setting up the work, handling of the work, and movements on the part of the operator.

Assuming that a weld footage of 40 ft. per hr. is satisfactory, our efforts to reduce cost must be directed to factors other than welding. Therefore, we want to make a thorough study of the job including the fixture in which the work is welded, the facility of the positioning or handling equipment, the accessibility of the joints, and any other considerations having a bearing on the work. Approached in this manner, any job will be easy to analyze as far as cost is concerned.

It is easy to visualize the savings which might result from a careful cost analysis. Suppose, for instance, the set-up time was reduced from 2 hr. to 35 or 40 min. Assuming that the time is worth $2.00 an hour, we would have a cost reduction amounting to between $14.00 and $18.00.

The savings to be obtained more than justify the study of various operations which make up costs. By carrying out this study in a systematic manner, very interesting results are likely to be obtained.

The method of cost reduction as presented here will be found helpful in all operations involving step welding, such as simple frames, where it is difficult to measure the actual time required to make each weld.

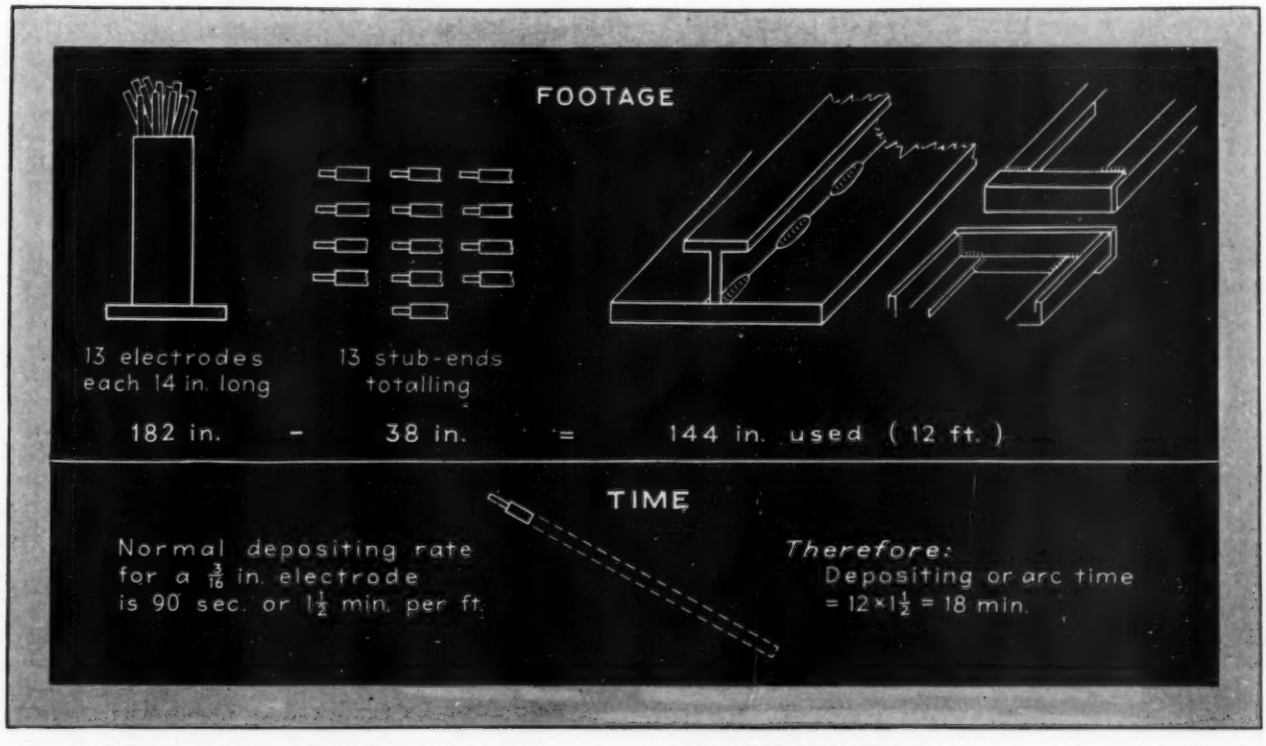

FOOTAGE
13 electrodes each 14 in. long
13 stub-ends totalling
182 in. - 38 in. = 144 in. used (12 ft.)
TIME
Normal depositing rate for a 3/16 in. electrode is 90 sec. or 1½ min. per ft.
Therefore:
Depositing or arc time
= 12×1½ = 18 min.

Fig. 2—The operator, issued 182 in. of electrodes, returns 13 stub ends or 38 in. The 144 in, of metal was deposited in 18 min., although the welder actually worked 3 hr. Cost reduction therefore involves a study of welding fixtures, material-handling equipment, accessibility of joints, set-up time and work interruptions

Every transaction at the tool crib window is covered by a complete, written record signed by the workman

Two copies of each tool request are filed in this series of clip boards near the tool crib window

The Tool Crib Pays Its Way

It's no longer merely a storage space. The modern tool crib cuts down lost productive hours and effectively controls tool inventory

By JOHN A. BISSINGER, JR.
Superintendent, Machine Shop
Engineering Works Division, Dravo Corporation

SOMETIMES we think of a tool crib as a necessary evil. This is as erroneous as the idea that production control and budgeting are a waste of time. A tool crib is really a productive unit; the attendant performs a productive function when he makes tools available to the workmen with the least possible delay.

A good tool crib system must satisfy the following requirements: (1) rapid service for productive workers, (2) tool inventory must be held at a minimum, (3) expenses caused by tool breakage and loss must be held at a minimum, (4) records must be accurate, simple and complete, (5) responsibility for tools removed from the crib and for tools damaged must be placed on an individual workman or supervisor, (6) tools must be inspected and repaired upon return to the crib, (7) two or more tool cribs must be interlocked into an integrated system, and (8) repair of tools must be performed in an economical manner.

First, full responsibility must be placed in one man; it is not economical to permit separate departments to operate their own tool cribs. It sometimes is said that each department knows best what tools it needs and how to maintain them properly. In theory this is true, but it seldom works out well in practice. Many plants that operate with separately controlled tool cribs admit that the tool control system in use is the weak link in their plant.

To be efficient, a tool crib must have a modern method of accounting for all tools for which the crib is responsible. To some this may seem expensive, but industry does not hesitate to institute modern accounting methods in all other parts of the business; it has been found to pay well. The same is true of the tool crib. There have been many methods based on variations of the brass check system; all of these have, more or less, failed to give an accounting of tool loss, breakage, turnover, inventory and loss of productive time at the tool crib window.

To properly account for tools, we must: (1) Have a complete record of each transaction at the window, (2) account for lost or broken tools, (3) know repair costs immediately, (4) be able to show tool turnover, (5) provide a record of tool breakage and lost tools for the foreman of each department, (6) identify certain types of tools by serial numbers in order to avoid one workman turning in tools assigned to another, (7) classify tools under a simple number system, (8) be able to make a quick and thorough inventory of tools.

If we follow through the above

step by step, there is only one answer; that is a paper record. The common reaction to a suggestion for additional paper records is that we already have too many reports to fill out now. That may be true, but it is not true if the correct system is in use.

Under the tool control plan now in effect in the Engineering Works Division of the Dravo Corporation, the workman, when he requests a tool at the crib's service window, sets in motion a series of steps in the tool accounting system. First, he makes out a tool request form in triplicate, as shown in Fig. 1. The tool classification number is added by the tool attendant when the requisition is presented at the crib. The original copy then is filed in a rack under the workman's check number or name, and the second, or carbon copy, is filed in a similar rack under a clip identified by the tool number. The third copy is given to the workman as his record of the transaction. When the tool is returned, the workman brings with him his copy of the requisition, which helps the attendant in finding and removing the first two slips from the files. The original copy then is returned to the workman if the tool is found to be in good condition.

When the tool returned by the workman is in poor condition, showing evidence of misuse, his record is not cleared until he returns a defective or damaged tool report (Fig. 2) signed by his foreman. On this form is entered the replacement price if the tool cannot be redeemed, or the repair cost if it can be salvaged. We do not delay a workman if his foreman is not available, but issue another tool to him, on another tool requisition, and then have the foreman sign the damaged tool report later.

In order to record the turnover of tools we make use of the second copy of the tool request form. After the workman returns the tools to the crib, the second copy of the original requisition is filed in the back section of the rack. These dead slips are counted and recorded at the end of the month to show the turnover of each type of tool. At the end of several months, the tool turnover report (Fig. 3) shows distinctly the items that have little use and can be removed from the crib. A foreman will hesitate to order extra tools when confronted with evidence on the tool turnover report that these tools are not needed.

A record of all slips showing damaged or broken tools is recapitulated weekly in a defective tool report, Fig. 4. A copy of this report is turned over to the superintendent or foreman of each department, another copy is kept in the tool supervisor's file, and a third copy is sent to the Works Manager. The individual supervisors make a definite effort to reduce their tool loss and breakage account when provided with these weekly reports. They soon catch the repeaters, especially since the tool breakage is charged to the individual department's overhead. In one case, tool breakage was reduced to 25 per cent of the former value within a short time after the reports were inaugurated.

Certain types of tools must be identified, or workmen will attempt to turn in tools assigned to another workman. We mark such tools with serial numbers, so that if a man turns in a tool not assigned to him, we keep it and notify the man to whom it originally was assigned. The offender is required to find and turn in the tool issued to him. It often is surprising how quickly they can do this. It requires only a few months of operation of the tool accounting system to show which tools should be given identifying numbers.

The heart of a good tool system is the classification of all tools. This should be simple and easily explained to the tool crib attendant. We prefer a classification system using numbers only, and have set up a variation of the standard decimal system arranged to cover every type of tool in use in our plant. By this system it is easy to identify any variety of tools; we have, to date, used only 150 series of the 1,000 available, leaving 850 series available for future use on jigs and fixtures.

The system takes care of drills, wrenches, measuring instruments,

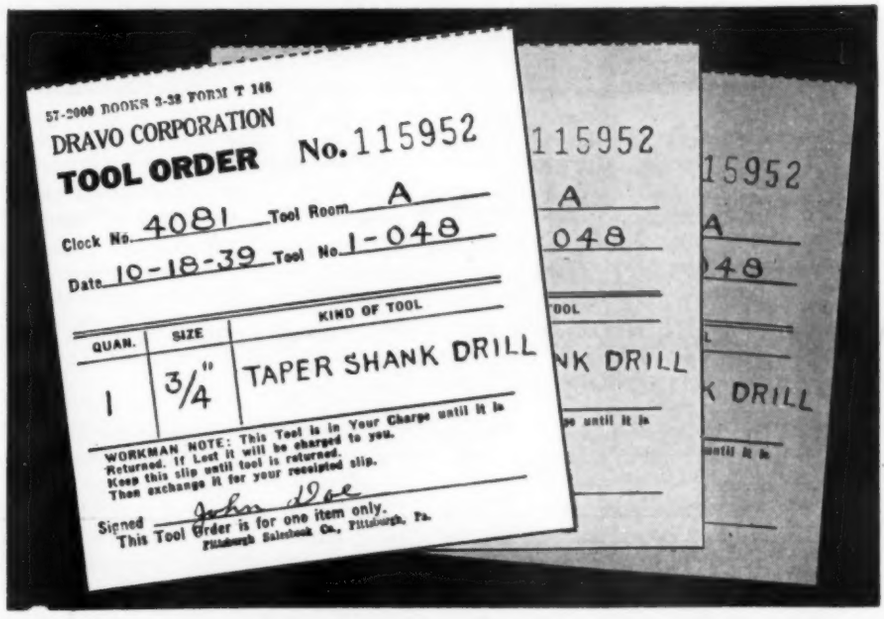

DRAVO CORPORATION
TOOL ORDER No. 115952
Clock No. 4081 Tool Room A
Date 10-18-39 Tool No. 1-048
QUAN. SIZE KIND OF TOOL
1 3/4" TAPER SHANK DRILL
WORKMAN NOTE: This Tool is in Your Charge until it is Returned. If Lost it will be charged to you. Keep this slip until tool is returned. Then exchange it for your receipted slip.
Signed John Doe
This Tool Order is for one item only.

Fig. 1—Made out in triplicate by the workman when he needs a tool, this form gives a record of who has the tool, how many times the tool is needed in a given period, and fixes responsibility for misuse

Fig. 2—When a tool is damaged, the workman's record is not cleared until his foreman has signed one of these reports

T-156

DRAVO CORPORATION

MONTHLY TOOL TURNOVER REPORT--1938

Toolroom A

Tool No.	Description	Quan.	Value	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
1-042	2/32 T.S. DRILL			5	11	6	6	8	2	4	1	2	4	3	
-043	43/64 " "			1	1	2		1			1		1		
-044	11/16 " "			38	10	9	17	13	2	6	11	25	16	16	
-045	45/64 " "			1						2			2		
-046	23/32 " "			4	2		6	3	1	1	1	3	6	2	
-047	47/64 " "			1		2	3	3		1		3	5		
-048	3/4 " "			14	9	10	14	15	7	3	4	10	18	14	
-049	49/64 " "			3	1	1	3			1	1	7	4	2	
-050	25/32 " "														
-051	51/64 " "														
-052	13/16 " "														
-053	53/64 " "														
-054	27/32 " "														
-055	55/64 " "														
-056	7/8 " "														
-057	57/64 " "														
-058	29/32 " "														
-059	59/64 " "														
-060	15/16 " "														
-061	61/64 " "														
-062	31/32 " "														
-063	63/64 " "														
-064	1 " "														
-065	1 1/64 " "														
-066	1 1/32 " "														
-067	1 3/64 " "														
-068	1 1/16 " "														

FIG. 3

FIG. 4

T-150

DRAVO CORPORATION

Weekly Defective Tool Report

From OCT. 23 To OCT. 30, 1939 INCLUSIVE

Tool Room A

Tool Number	Description of Tool	Check Number	Workman's Name	Dept.	Nature of Defect	Cost of New Tool or Repair
1-026	13/32" T.S. DRILL	1804	J. DAUGHERTY	ELECT.	BROKEN-RECLAIM 3/4 LENGTH	0.25
128-011	5/16" BOLT TAP	1830	C. SHIREY	"	BROKEN-SCRAP	0.57
90-015	SLEDGE	3011	J. BATTISTO	STRUCT.	BROKEN HANDLE-36 IN.	0.53
98-010	WELD GLASSES	3039	R. PALAZZINI	"	BROKEN LENSE	1.55
98-001	GOGGLES	3111	S. SUDIA	"	REPLACE HEAD BAND	0.20
90-026	WELD HAMMER	3188	S. GALBA	"	WORN OUT	1.16
2-022	11/32" S.S. DRILL	3095	S. BURAN	"	BROKEN-SCRAP	0.56
					TOTAL FOR WEEK	$ 4.82

Fig. 3—Regular tool turnover reports can be made to pay dividends. Inactive tools take up valuable crib space and often should be stored elsewhere. Frequently they can be transferred to another department where they will be used more often. This form also is used for regular inventories of tool crib stocks

Fig. 4—Weekly recapitulations of all slips showing damaged or broken tools are given to the departmental supervisors and the Works Manager. Tool breakage is charged to the individual departments overhead, so every effort is made by the supervisors to hold this account at a minimum

taps, thread gages, jigs and fixtures, portable tools and many others. Miscellaneous tools of which there are only one or two in the plant are easily classified under one number. We use the six digit form of classification, of which the first three digits give the series into which the tool is classified, and the second three digits represent the size, type or tool serial number.

For instance, a $1\frac{1}{2}$ in. Morse taper shank twist drill carries the No. 001-080. The 001 digits indicate all high speed two-fluted twist drills, and the 080 digits represent the size in $\frac{1}{64}$ in. Thus 080 represents 80/64 or $1\frac{1}{4}$ in. A 1-in. diameter drill would be indicated as 001-064. Miscellaneous items are numbered arbitrarily.

Portable tools are classified by using the first three digits to indicate the type of tool and the second set of three digits to indicate the serial number of the tool itself. For instance, Series 124-000 is assigned to pneumatic riveting hammers of all sizes; Series 125-000 identifies pneumatic air drills and reamers; Series 127-000 refers to burning torches and hose outfits; and Series 154-000 is assigned to small electric hand drills. We give a plant number to all portable tools so as to readily trace and identify these tools, rather than use manufacturers serial numbers which would require using the name and model of the machine in order to identify it. Thus the No. 124-006 on a tool requisition slip indicates that the tool in question is a pneumatic riveting hammer carrying the plant No. 6.

Since different workmen receive their training in different industries and in scattered parts of the country, the workmen often will identify a tool by several different names, and will use various spellings and abbreviations for each name. The tool crib attendant identifies the tool by its serial number which automatically places it in its proper class. This requisition system will not function to produce the best results unless the tool can be identified accurately by some other means than the name assigned to it by the shop workman.

The tool control system outlined is readily applicable to one or one hundred tool cribs. This is because it has as its base a complete record of each transaction. The use of the classification system insures proper records in any number of cribs. Tools that are slow moving in one crib can be transferred to another crib where they are used more frequently. Reports show where there is a surplus of tools and whether additional tools of a given type should be purchased. By interlocking control of the tool cribs with the paper system, repair work charges are easily distributed and costs for new tools, tool repairs and records of tool life are assembled easily.

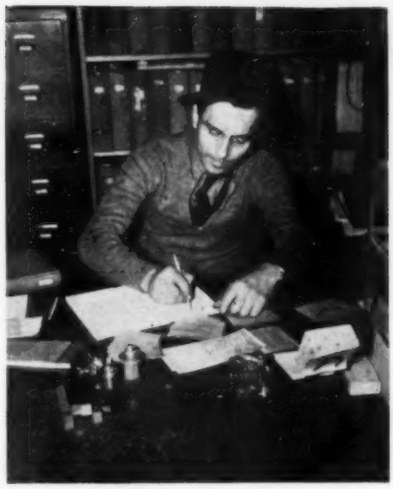
It easy to note tool turnover since, at the end of each period, all filed slips can be counted rapidly to give a tool turnover for that period. A tool attendant who handles 200 to 300 men from his crib window can take his turnover record in about two hours. The turnover record for each

size and type of tool is recorded on the monthly tabulated tool turnover report. This is used as a basis for ordering new tools and, if it is cheaper to buy certain tools in quantities, we are able to figure out the most economical quantities.

Knowing our tool turnover, we can plan the layout of tool bins for the most efficient handling of tools. We thus save the tool attendant many steps, speed up his service and make him available for many small repair jobs. We split our drill and tap bins, placing the ones most often used near the window and the others a corresponding distance away. We can easily predict the use of tools in our productive cycle. For certain jobs, we move certain tools nearer the window. When they cease to use this type of tool we may store them on the mezzanine in some toolrooms, or in bins farther away from the tool window.

Under the present system workmen are not so careless in their use of tools. Tool breakage on portable tools has dropped to about 25 per cent of that under the brass check system. Previously, if a man took out a tool and returned it immediately, saying it was defective, or in the case of portable power tools, that it was not functioning, we had no record of who had it out last, except the memory of the tool attendant, which is not always reliable. Under the present system we refer back to the last man using this tool and charge the repairs against him. This has eliminated most of the trouble caused by defective tools being turned in with no report to the tool attendant by the user.

Under the brass check system we could handle approximately 60 transactions an hour per crib attendant, and he was kept extremely busy. With the tool requisition system, we can handle as many as 125 transactions per hour per man without difficulty. This figure is based on time studies. The saving is due to the speed with which a transaction is completed, especially in the return of the tool to the crib by the user. There is no delay. A quick check inspection, maybe a question to the user, and the original slip can be removed quickly from the rack and returned to the workman. Removal of the slip from the active tool record file to complete the transaction can be done later. We think that 80 to 90 transactions an hour are all a tool attendant can handle efficiently during the early and latter parts of the day. During most of the day he will handle 40 to 60 transactions per hour.



It is easy to record tools turnover, slips accumulated by a crib serving 200 to 300 men usually can be counted and recorded in two hours at the end of each month

Quite often we have been questioned about excessive delay caused by men who speak broken English or cannot write English. This should be especially true where a large foreign element is employed. We have found that there is little trouble caused by this, since the few who cannot write are usually on jobs requiring few tools and the others seemingly do not slow down the speed of operation of the system. Our foreign group is large, but has presented no particular problem in the operation of the system.

We have used our tool crib attendants for more repair work than formerly and even have had other departments turn over to us minor repair jobs that occur frequently. With the speed of the requisition system, a tool attendant is available for a considerably greater period of time to sharpen drills, make simple repairs on portable power tools, repair burning equipment, paint spray equipment, disinfect and repair respirators, goggles and welding helmets. They also repair hammer handles, dress striking tools and grease portable pneumatic tools.

Before we installed the tool requisition plan it was costing us an average of $1,200 a month for one tool crib, the first placed under the tool requisition system. We started a gradual reduction in operating costs until we have decreased this to about $700 a month, at the same time stepping up the service and making a greater number of tools available. Other savings include cost reductions in tool breakage and loss, reduced inventory, and the introduction of a thorough inspection.

When Is a Tenth Not a Tenth?

By ED WEST

WE HEAR a lot of talk around some shops about working to "tenths" but when we see some of the gaging methods we are inclined to doubt that their "tenth" is the same as someone else's. In many cases we find inspectors gaging work after washing or heat-treating process and before the pieces have come down to room temperature or the temperature at which the machining operation was performed. For that matter, we find that parts which are supposed to be assembled with close tolerances are not even being gaged at the same temperature although other things such as machining temperatures may be comparatively equal.

When one attempts to hold tolerances to the fourth or fifth decimal place such factors as the pressure of the gage points on the material, the temperature at which the readings are taken, and the nature of the gaging contacts themselves all have a bearing on the accuracy of inspection. The softer metals are particularly affected by the amount of pressure which is applied to the gaged contacts. We know of several cases where diamond points had to be eliminated and other types of contact surfaces used in checking the diameters of cast-iron cylinders.

One of the neatest tricks we ever saw with reference to licking the temperature problem is used in a shop where small parts are made to close tolerances. In this particular shop the conveyor lines come right out of the wash and carry the parts through a temperature cooling chamber. The chambers are built around the conveyors and arranged so that all parts come out at 70 or 72 deg. no matter what the incoming temperature. Parts are promptly inspected at stations adjacent to the conveyor.

Miscellaneous Press Tools

Specific examples of press-tool design principles are found in such diverse operations as beading cartridges, reverse drawing electrical parts and forming brackets

By C. W. HINMAN
Tool Engineer
Kobzy Electric & Tool Mfg. Company

RIM-FIRE CARTRIDGES are commonly fabricated in a combination blanking and drawing die that produces six or eight shells per press stroke. The walls of the shells are drawn thinner than the original material thickness; therefore, the shell bottom is slightly thicker than its sides. Four redrawing operations are usually necessary, depending on the amount of shell-diameter reduction. The last operation consists of trimming off the mouth of the shell square. Annealing between draws is necessary to normalize most metals.

Die operations for heading cartridge rims are shown by the principles set forth in Fig. 180. The shells are agitated in a hopper, not shown, that causes them to enter chute *D*. If the open end of a shell enters the chute, the shell is turned end for end by striking hook *E* in magazine *F*. The shell is caused to fall, closed end down, as desired.

This well-known principle is often employed for reversing pieces of work before they enter dies and special machines. For irregularly shaped pieces, the hook contour is shaped to suit indentations in the work. If a shell enters the magazine, closed end first, the head of the shell hits a point on the hook, the shell rebounds slightly, and then falls head first into the magazine in regular order. Slide *G* pushes the shells ahead against a stop and under the punch of the press tool.

The punch pilot enters the shell, and a shoulder on the punch pushes the shell into the die. When the shell protrudes through the die, as seen at *A*, an anvil is advanced by a cam as shown at *B*. Sketch *C* shows the rim completed. This operation is called "beading," and is a principle frequently used in many other types of die-worked parts. After the rim has been formed, a quick fall in the cam causes the anvil to recede suddenly, and the finished shell is pushed through the die.

Small cartridge shells can also be blanked and drawn in multiple-plunger eyelet machines, when annealing can be avoided by using materials of sufficient ductility. The metal will withstand more frequent redraws without annealing, because the shells are worked continuously while warm. Continuous redrawing operations are more advantageous than operations done in separate tools, in which the metal becomes cold between draws.

A coil mounting base, Fig. 181, is an example of work for which reverse drawing dies can be used to ad-

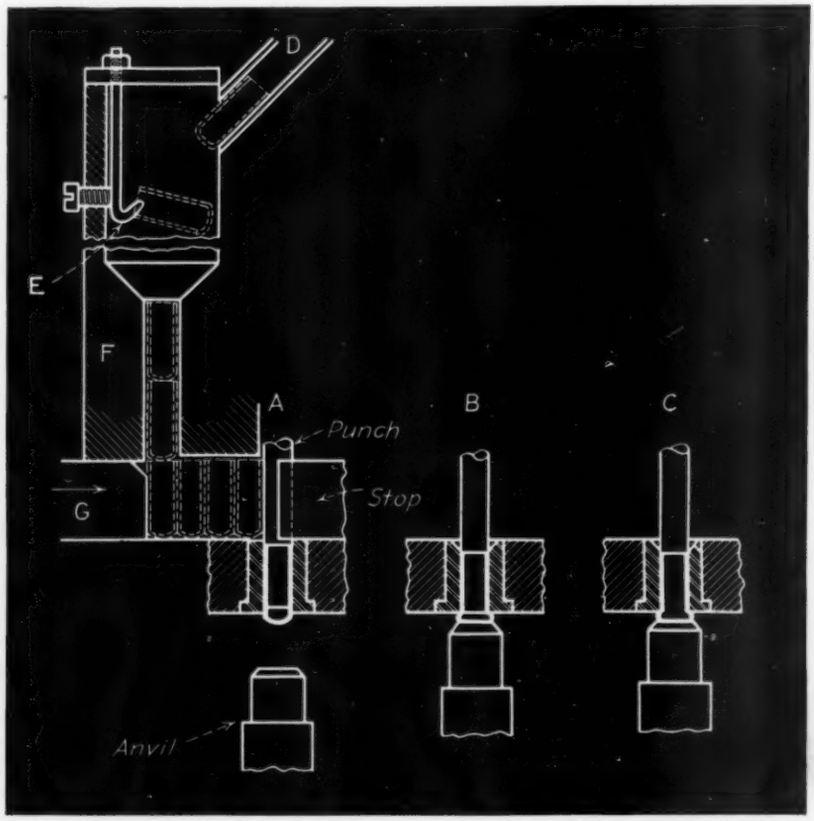


Fig. 180—A shouldered punch pushes the shell partially through the die, so that a cam-actuated anvil coming up from below can bead the rim-fire cartridge

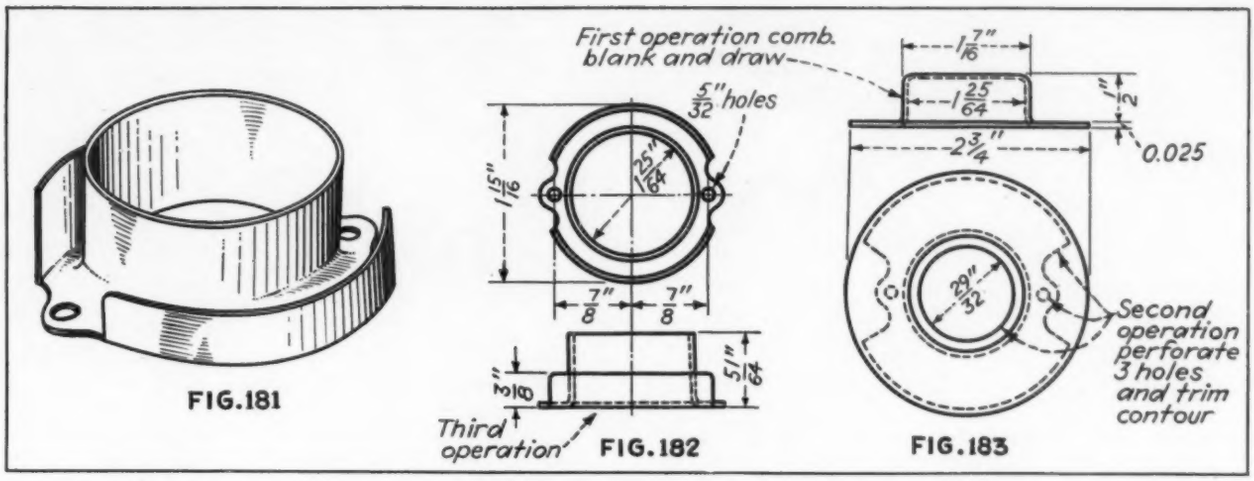


FIG. 181

FIG. 182

FIG. 183

Fig. 181—Three operations are needed to produce this coil mounting base. Fig. 182—Dimensions are given on the third-operation part. Fig. 183—Solid lines indicate the first-operation stage, dotted lines the trimming and piercing done in the second operation; the finished depth of 51/64 in. is obtained in the third operation

vantage. The material is deep-drawing steel 0.025 in. gage, which is usually specified SAE 1010. Three die operations are required to produce this piece.

The first operation is done in a combination blanking and drawing die, similar to one previously shown in Fig. 168 (*AM*—Vol. 83, page 634). The shell body is drawn to the correct finished diameter, but only ½ in. deep, Fig. 183. The finished depth of 51/64 in. will be obtained in the third operation. The combination die is set to leave a flange approximately 2¾ in. in diameter, which is later trimmed and reverse drawn ⅜ in. high to form the outer rim segments.

The second-operation die, Fig. 184, pierces two 5/32-in. holes in the flange, and a 29/32-in. hole in the bottom of the cup. This die also trims the contours around the holes in the flange, and blanks the outer edges simultaneously. Two chisel cutters sever the scrap frame so that it falls away from the die in two pieces.

The perforating, blanking and trimming operations are performed at the same time. This means that the punches are at different levels, likewise the dies. No difficulties in grinding are involved because the

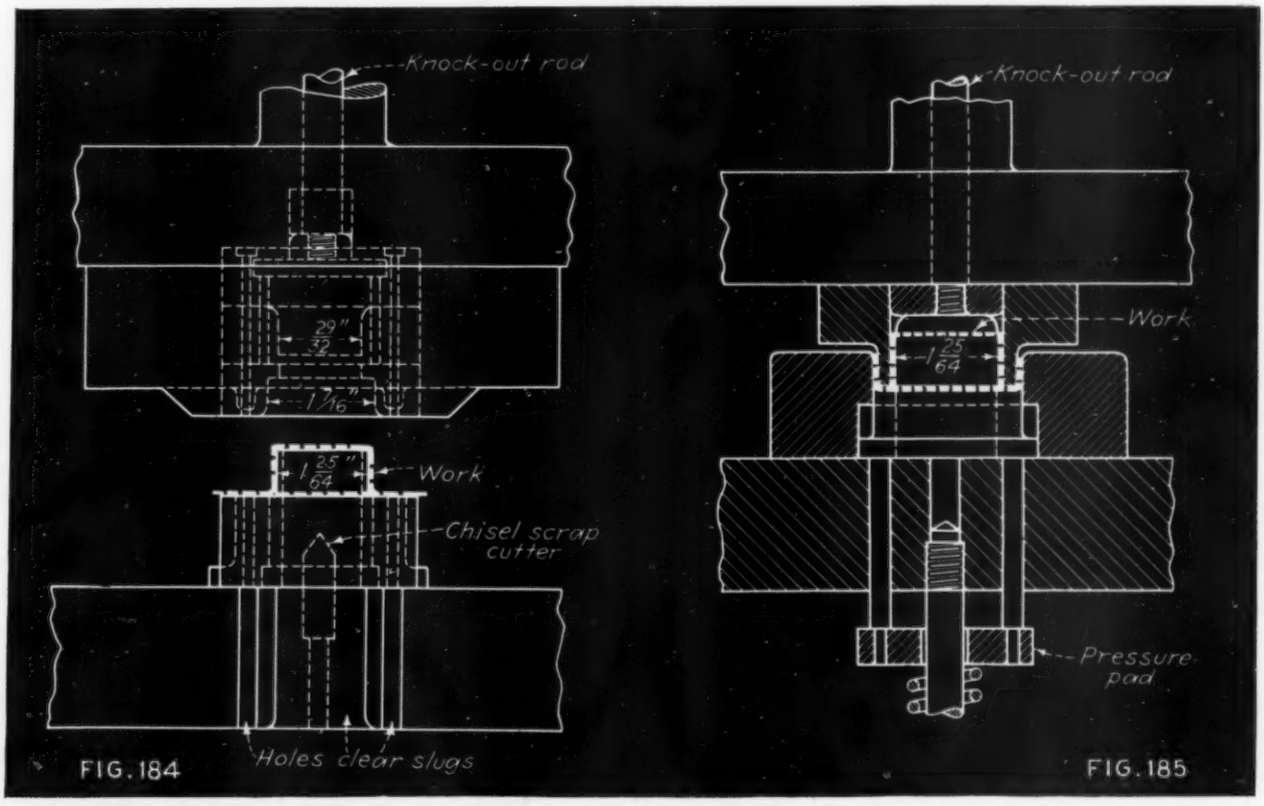


FIG. 184

FIG. 185

Fig. 184—The cup is drawn only ½-in. deep, and the second operation pierces a 29/32-in. hole in the bottom to leave metal in an annular rim. Fig. 185—Stretching out the annular rim throws up the sides of the shell to the correct height

upper and lower dies are separate pieces, and can be removed for grinding.

The stripper plate has a center hole that clears the body of the work, and is operated by a knockout-rod through the punch stem. Three stripper bolts, not shown, retain the stripper plate in place.

The third, and final, die operation, Fig. 185, stretches out the annular rim left by the $\frac{29}{32}$-in. hole previously pierced. This die also draws up the outer rim segments, as specified. Stretching the hole and throwing up its sides adds $\frac{19}{64}$ in. to the height of the shell, and completes the $\frac{51}{64}$-in. dimension. The fit between the punch and die must be close, because the piece must "bottom" on the die, and the opportunity is limited to iron out the crease where the bottom and sides of the shell join. It will be observed that the trimmed ears project beyond the outside diameter of the finished cup. This condition complicates the final redrawing die somewhat. The part is carried up with the ram ascent. It is stripped from the punch by a pressure pad under the die, and is finally ejected by the knockout-rod with its attached pad.

Inexpensive Dies

The shape and dimensions for a hot-rolled steel part, of which it is assumed only 2,500 are needed, is shown in Fig. 186. No repeat orders are expected. The developed length of the blank is 21.414 in. The punch holder and die shoe are purchased without guide posts, and the tool is aligned in the press by using "set-up pins" shown at diagonal corners of the die in Fig. 187.

In operation, the material strip is fed from the right-hand side of the tool. The strip is guided between two hardened backing-up heels *A*, and under the cutting-off punch *B*, across the cutting-off edge *C*, and then over spring-pad *D*. The forward end of the strip finally stops at the extreme left end of the tool by contacting the 45-deg. angular block *E*. The angular block swerves the strip, and causes it to register within the front stop block *F*. Backing-up heels are fitted against the right-hand side of the die-shoe slot, and project $\frac{3}{8}$-in. above cutting edge *C*. These heels guide the cutting-off punch when the ram descends.

The strip is now in position for the first operation, namely, cutting off, bending the four angles, and embossing two circular indentations. Perforating the two square holes in the ends is performed at the second station. The press being tilted, the first-operation piece is easily pushed from the spring-pad and into the second position, just off the pad and towards the rear of the tool.

For the second operation, the work is gaged endwise in a cleared opening $17\frac{13}{16}$ in. long, which is the distance between the two die blocks *G*. The work is retained in position by two short stop pins *H*. Perforating punches are stripped by two "sky-hooks" *J*, when the ram ascends. These hooks are provided with considerable clearance spaces underneath them and are firmly attached to the die shoe. When the ram ascends, the work is carried up by the punches. When stripping occurs, the press inclination causes the work to slide off the die and to clear the short stop pins *H*. Finished pieces fall into a suitable tote-box placed behind the press.

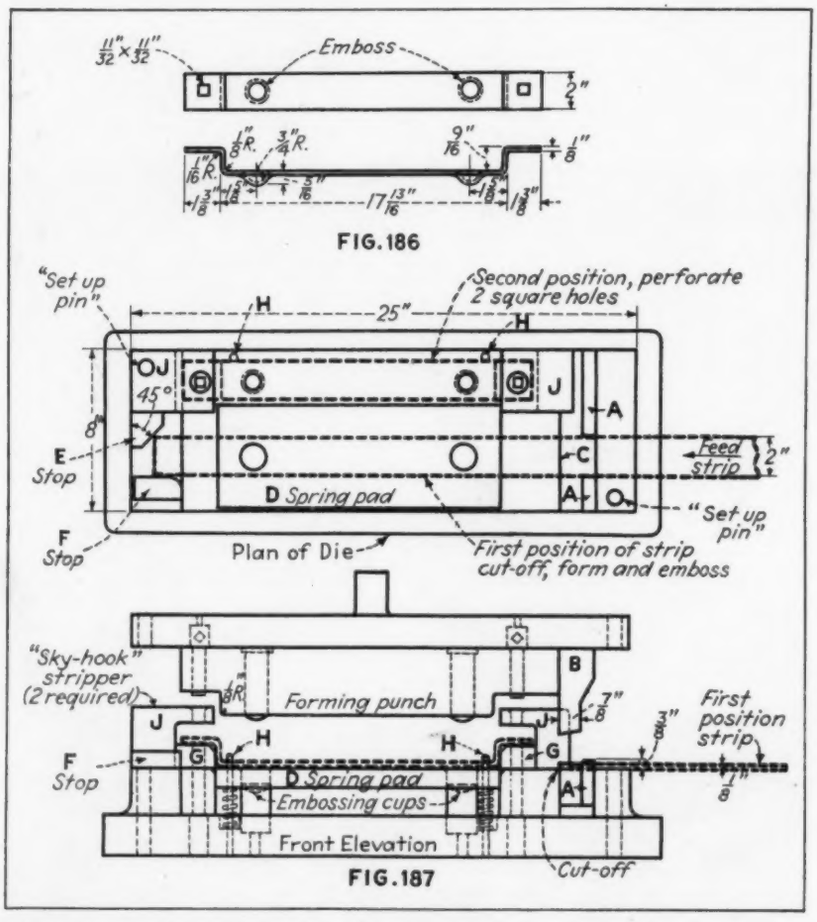


Fig. 186—A short run on this part required development of an inexpensive two-operation tool. Fig. 187—The formed first-operation piece is pushed back in the tilted tool to a cleared opening at the second station for piercing the two square holes in the ends

Part 30 of Mr. Hinman's series will be published in an early number.

Welded Locomotive Cylinders

Welding marches on. The latest spectacular job is the making of a complete locomotive saddle including both cylinders and piston valves. Most interesting of all the claims are that it weighs 25 per cent less (and this means a saving of two tons in weight) and cost 24 per cent less than the casting.

Of course both cylinders and valve chambers must be bushed with cast iron to get a good wearing surface. But this is also true with cast steel cylinders. It's good practice to use bushings as they can be easily renewed.

Just how this welded construction will show up in a wreck remains to be seen. Welded cylinders are not as likely to crack as castings. But if distorted they may cost more to repair than the broken casting. Time and experience will tell the story.

Skilled Workers for Tomorrow

It's no accident that Detroit is graduating 300 apprentices this fall. A regular program started in 1935 makes it possible. Here's how it works

By RUPERT LE GRAND
Detroit Editor, American Machinist

THIS FALL in Detroit some 300 boys will graduate from apprentice training courses. That this number represents a tenfold increase over last year's is no accident but rather a tribute to the city's Employers Association, which five years ago decided to do something to provide a regular flow of trained apprentices into the ranks of skilled workers.

And do something it did. In Detroit of all places, where a lad can pull down a man-sized wage if he can land a job on an assembly line, it's no easy matter to persuade him to put in four years "learning a trade" at apprentices' pay. But the fact that every boy graduating this year will have had four years of training and 8,000 hours of instruction—despite violent business fluctuations—proves the association's work has not been in vain.

Right now there are 932 four-year apprentices being trained in 25 plants under the auspices of the association, and about 900 more are enrolled in the Ford Apprentice School. Neither group includes persons being given instruction in semi-skilled occupations or older men being retrained for better positions in the shop.

The present number of apprentices in Detroit is made up of 292 machin-

ists, 285 tool and die makers, 18 templet and wood workers, 40 pattern makers, 25 molders and core makers, 40 draftsmen and designers, 103 maintenance workers such as millwrights and electricians, and 129 in miscellaneous occupations of which many are peculiar to the automotive industry.

Despite efforts of the Employers Association, the number of apprentices under training is still considerably affected by the business curve. In 1937, two years after the program had been started, Detroit had 1,198 boys under instruction in 45 or 50 plants. Since 1938 the number of cooperating concerns has shrunk to the 25 larger plants whose operations have not suffered as much as the smaller ones. Other causes for the shrinkage in number of apprentices are drop-outs and graduation. This year, for instance, relatively few replacements will be made, but the organization is available to go ahead with the program as business improves.

Not All Clear Sailing

Detroit employers are anxious to resume volume training of apprentices but adverse factors are: (1) insufficient business to warrant increasing shop forces and particularly the expense of enlarged training programs, (2) some antagonism on the part of organized labor, which makes certain demands with respect to rehiring older men with seniority and to the number of apprentices with respect to journeymen, and (3) the difficulty of securing suitable material.

Thousands of applications are on file for apprentice training. Most of these can be weeded out as being unsuitable. The employer must have good material and be reasonably certain that the boy will stick. High-school graduates are chosen. They must be as young as possible. Sixteen-year-old graduates are the most desirable because they have shown ability to learn rapidly. But eighteen is the minimum age at which boys can be hired without entering into special arrangements. Boys between sixteen and eighteen can be taken on with a special government permit limiting the type of training which can be given to boys of that age. It is not always possible for employers to segregate younger apprentices in departments where so-called hazards do not exist, and thus they are often prevented from taking on younger boys with permits. Boys of nineteen and older are not desired because they will not be making a man's wage until well past 21, and may be tempted to throw over their indenture by desire to make more money, to achieve marriage for example.

A serious factor in limiting desirable applications is previous training. Boys with college preparatory schooling usually expect bigger things than a journeyman's wage and may become discontented with the slow process of working up through the shop. High-school graduates without some shop training can not be expected to know whether they really want to become skilled mechanics. It may be only a temporary notion instilled by chance contacts or unknowing parents.

Scholastic rating also bears upon selection of apprentices. Boys with A grades may become dissatisfied, those with C grades are not considered likely to become good mechanics.

These limitations reduce the field to high-school applicants with a B scholastic record, a good personality, first-class physical qualifications, some shop training secured in technical high schools or trade schools. The last qualification eliminates a great many from communities which do not offer such advantages.

Indentures Used

No standard indenture is used by the plants cooperating with the Employers Association. During the last two years, however, there has been a trend toward the use of indentures, not because they can really hold a boy who wants to drop out, but because they lend dignity to the program in the eyes of the boys and their parents. The indenture also overcomes hostility of certain unions or outside groups, because it outlines definitely the training to be given.

Boys who undergo apprenticeship in Detroit are relatively more fortunate in achieving a steady income than many others of similar age, and they are better off in earlier years at least than many of those who enter the professions. The beginning wage is approximately 45 cents, and this is increased by five cents at six-month intervals. Thus, upon graduation the young journeyman gets at least 85 cents per hour and may be given 90 cents, which is the entering rate for a machinist or toolmaker.

It is the contention of the Employers Association that at least 5 per cent of the skilled force is lost annually because of retirement or death. Unfortunately the same percentage of apprentices will not fill the gap. At least 20 per cent of the shop force must be in training because it takes four years to make a skilled mechanic.

One Detroit Company's Apprenticeship Course

(Some subjects in curriculum are covered in night classes)

FIRST YEAR

- Shop Mathematics
- Technical English
- Industrial Economics
- Industrial Chemistry
- Principles of Engineering Drawing, and Body and Die Blueprint Reading
- Drafting and Views of Diagonal Sections
- Safety Practices
- Use, Care and Reading of Tools
- Machine Shop Technology

SECOND YEAR

- Applied Mathematics
- Metallurgy
- Shop Theory
- Die and Part Print Reading
- Practical Methods and Proper Machines to Use
- Construction of Problems
- Machine Shop Technology
- Compound Indexing

THIRD YEAR

- Metal Analysis
- Heat-Treating
- Arc and Acetylene Welding
- Panel Design
- Gear Calculating and Cutting
- Machine and Die Design (arranged to put former experience into practice)

FOURTH YEAR

- Motion Study
- Elements of Supervision
- Strength of Metals
- Tool and Die Design

Scrap heaps often cost more than they are worth. Unless the scrap is sorted you may spend time enough hunting to pay for new material.

IDEAS FROM PRACTICAL MEN

The Wabble Principle in Jig Construction

By L. KASPER

A drill jig embodying the well-known but little-used wabble principle for actuating the clamping mechanism is shown in the illustration. The work, indicated by heavy dotted lines, is placed in a channel in the jig and is located by the stop pin *A;* the guide bushing *B* for the drill is held in plate *C*. The clamping bar *D* is slidably mounted in a groove in the jig body and carries the equalizing foot *F* at one end, while at the opposite end it carries the swivel blocks *H* and *I*, both of which swivel in a horizontal axis. The wabble member *K* rotates freely on a stud and is retained thereon by the collar *L*. It carries the split yoke or strap *M* which transmits horizontal movement to the clamping bar *D* through the swivel blocks *H* and *I* and is prevented from revolving with the wabble member by a pin engaging swivel block *H*. While the periphery of the wabble member is cylindrical in shape, it having been turned on opposite offset centers and is concentric with its hub, the axes of the hub and the wabble member are at an angle with one another and intersect at the center of the wabble member.

Referring to the illustration, Fig. 1 is a plan view, while Figs. 2 and 3 are end views. Fig. 3 shows yoke movement after wabble member has been given a partial revolution.

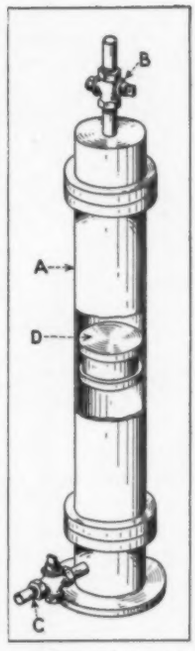
In operation, as the operating lever is turned the wabble member rotates on the axis of its hub, causing the yoke to swing in one plane while the wabble member rotates in another plane. Since the yoke is connected to the clamping bar through the two swivel blocks to prevent binding, any general horizontal motion is transmitted to the clamping bar, so that when the turning movement of the operating lever is continued, the equalizing foot contacts the work and clamps it firmly.

The salient features of the device are that the rotation of the wabble member produces a comparatively long stroke of the clamping bar, making permissible a wide variation in the thickness of the work to be clamped; that the pressure of the equalizing foot on the work is high in comparison with the turning effect applied to the operating lever; and that the tendency for the clamping pressure to reverse or overhaul the wabble member is practically nil.

Pneumatic Gun Simplifies Regrouting Job

By ELTON STERRETT

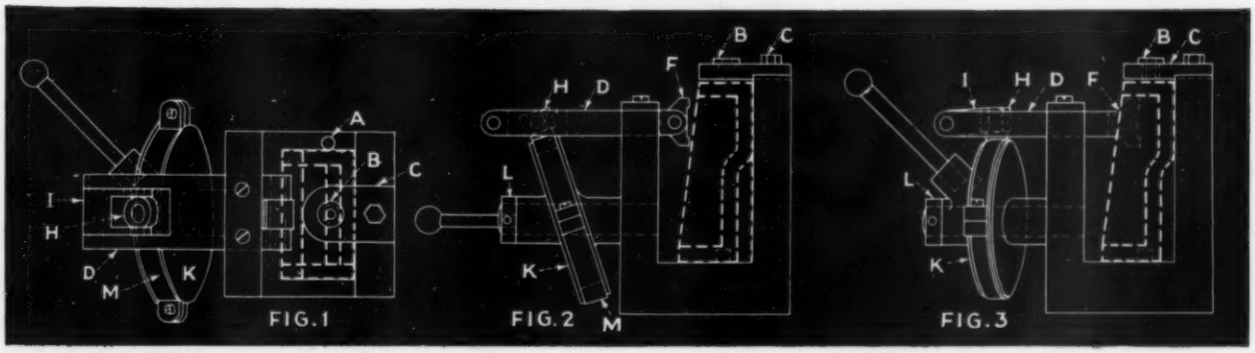
When foundation bolts developed looseness in a pumping station it was though that the bolts had stretched, but it was found that oil seepage had softened the grounting so that it had been disintegrated by vibration of the pump. The original grout had not been fully worked under the pump



Grouting between the foundation and the base of the supported unit can be applied quickly with this pneumatic gun

base, and more than the computed weight was being borne by small areas of cement.

In regrouting, the pneumatic gun illustrated was used. Essentially it consists of the barrel *A* made of a 4-ft. length of 6-in. pipe comparatively smooth on the inside and having the ends grooved for separable couplings of the "victaulic" type; short sections of pipe with welded ends for closing the barrel, the upper one having a pipe and a valve at *B* for controlling the air pressure, the lower one having a 1-in. outlet at *C* for the grout and having a wide base for stability; and the 4-in. oak piston *D* (operated by compressed air). The faces of piston are provided with leather washers slightly larger than the bore of the barrel. The grout was handled from gun to foundation through a short length of hose having a flattened nozzle which causes the



Horizontal movement is transmitted to the clamping bar by the yoke through swivel blocks as the wabble member is given a partial revolution by the operating lever

grout to flow out in a thin stream into very narrow spaces.

To refill the gun after a charge of grout had been delivered and the piston had been forced to the end of its downward travel, both heads were disconnected and the upper one was clamped in the place formerly occupied by the lower one. After filling the barrel with grout on top of the piston, the lower head was clamped in the place formerly occupied by the upper one and the gun was turned end for end and the air pipe was connected to the air line. The gun was then ready for placing another charge of grout.

Exact Contours on Dies Made By Grinding

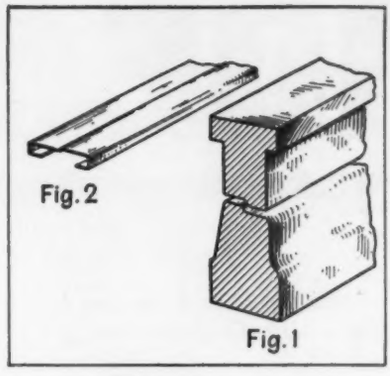
By HAROLD VALENTINE
Chief Engineer
Atlantic Manufacturing Company

By grinding contours on die blocks, the Atlantic Manufacturing Co., has found that it not only can produce work held to close tolerances, but also it can save labor and machine time as compared with other methods. To illustrate, take the die shown in Fig. 1 for forming molding used in automobile bodies. This molding, shown in Fig. 2, is produced with the single stroke of a high-speed press. The flanging of the lower edges, of course, is done by the use of toggle wings of the die, which will not be discussed here.

The die blocks are machined first to approximate size and then hardened, after which the exact contour is obtained by grinding. The grinding wheel is initially contoured to the desired shape by a Vinco tangent radius dressing tool. Thereafter, the contour is maintained by a dressing roll machined to the contour desired on the grinding wheel.

This dressing roll, made of oil-hardening tool steel, is machined to the exact male and female contours desired, both contours being made on the one roll for the sake of simplicity and economy. It is afterwards milled with a series of $\frac{1}{16}$-in longitudinal slots, cut at 10 deg. with the axis and extending deep enough to show in the deepest portion of the finished roller. The width of the segments thus formed is not uniform but varies from $\frac{1}{8}$ in. to $\frac{1}{4}$ in. at the periphery, segments of different widths being purposely mixed around the periphery of the spool so as to provide the chiseling action to dress the wheel.

After turning and milling, the roll is hardened and mounted on a spindle set in a block adapted to be held by the magnetic chuck of a grinder, as shown in Fig. 3. The grinding wheel must be turned by hand during the dressing operation as the device would be entirely too severe at high peripheral speed and injury to the wheel surface would result. The wheel face is brought into contact with the dressing roll by adjusting the table to suit. Then, with the wheel rotating at about 40 r.p.m., the table is moved back and forth and at the same time it is advanced frequently by the vertical movement to compensate for the wheel-face removal.



Figs. 1 and 2—The contours on the male and female sections of this die, used for forming automobile-body molding, were ground to shape. The grinding wheel was first contoured with a Vinco dressing tool and afterwards with the roll shown in Fig. 3.

Although but a single contour is shown on the die in Fig. 1, it is obvious that almost any contour on the wheel can be produced and maintained by the method herein described.

Fig. 3—Damage to the grinding wheel while dressing it to the desired contour is prevented by turning it manually with a crank

Why Not Mill Flats on Shanks of Small Tools?

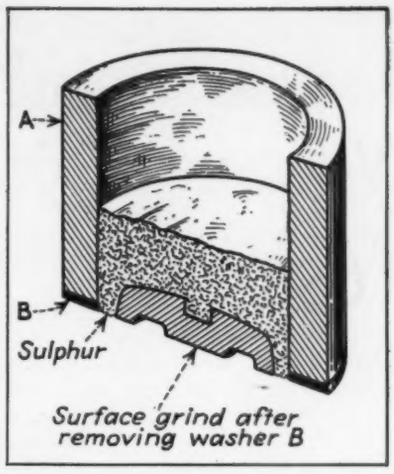
By CHARLES HOMEWOOD

Nearly all toolcribs have a number of small drills, taps and machine reamers, the shanks of which have been damaged by the carelessness of workmen in not tightening the chuck jaws on them properly, with the added result that the chuck jaws have become damaged and will, in time, lose their accuracy. There will be much less damage to both tools and chuck jaws if three flats are milled on the shanks of tools that are to be held in drill chucks, since such chucks generally have three jaws and can be easily and quickly tightened by hand to hold the tools securely.

Improvised Work Holder

By C. A. HOUGHTON

Some years ago I was confronted with the job of truing the badly worn control valves of Curtis air hoists. The valves were irregular in shape and all but impossible to hold in any standard lathe chuck. Furthermore, the working faces contained a lot of ports and other openings, presaging unsatisfactory results from lathe-tool finish.



With the valve inside, molten sulphur was poured in the holder and when it had solidified the valve was held firmly enough for grinding

A holder *A* was improvised by boring out a piece of round cast iron, intentionally using a fast feed, but carefully facing the ends. The washer *B*, about $\frac{1}{8}$ in. thick, was cut from one end of the holder and placed on a flat plate and a valve was placed in it. Then the holder was put over the valve, the lower end of the holder resting on the washer, as shown in the illustration. Molten sulphur was poured in the holder, covering the valve.

When the sulphur had solidified it was retained by the rough bore of the holder. The washer was pried off and the holder, with the valve inside, was mounted on the magnetic chuck on the table of a surface grinder, the sulphur-imbedded valve being uppermost. A few passes under the abrasive wheel produced a most satisfactory surface. When the grinding was finished, the sulphur was knocked out from the back of the holder, freeing the valve without injury.

So far as I know, the idea is entirely original, although I have since seen it used for holding work of such thin section that it would spring when brought into direct contact with a magnetic chuck.

Hollowed Oilstones Should be Trued

By JOHN E. HYLER

Many men have an aversion to using an oilstone that has been worn hollow in the middle, and some have even discarded such stones, having found no suitable means of truing them. Oilstones have been trued by holding their worn faces against the side of an abrasive wheel, but that method is not advisable because the material ground from the stone finds its way into the pores of the wheel and impairs its cutting qualities.

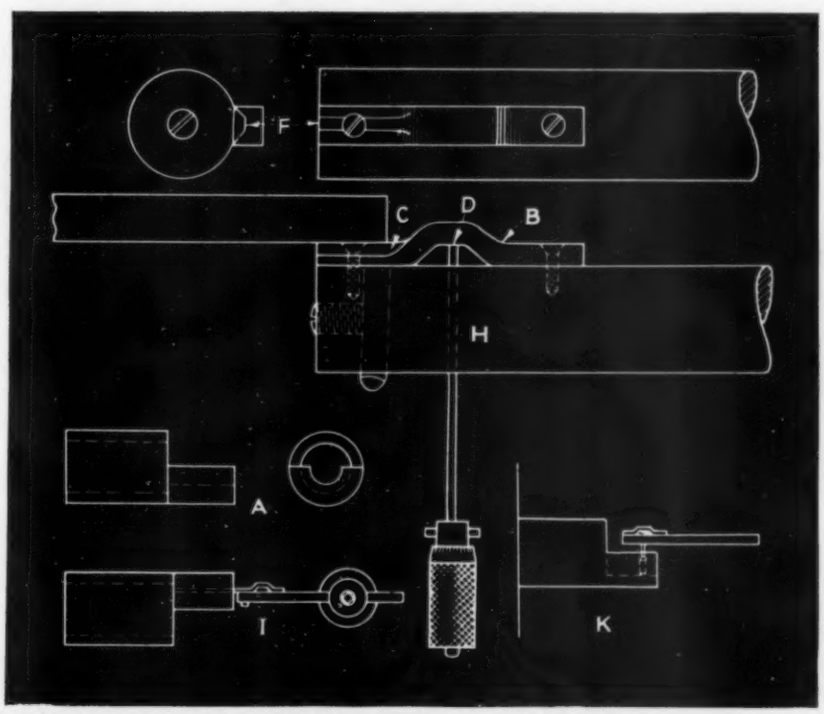
Where grinders equipped with abrasive disks or belts are in use, oilstones can be trued on them. Even if the truing is done when the abrasive has worn dull and just before the disks or belts are to be changed for new ones having sharp abrasives, considerable material can be removed from a badly worn stone. But perhaps the simplest method of truing an oilstone is to rub its hollowed face on a concrete floor, walk, or machine foundation. By rubbing the stone briskly while putting considerable pressure on it, the high parts will soon be ground down to the level of the hollow spot. That method is especially effective for stones that are artificially bonded.

Measuring the Radius of a Half-Bore

By H. MOORE
Kirkstall, Leeds, England

In boring a sleeve having one part cut away to or below the center line and in which a half-hole is to be bored smaller in radius than that of the hole in the other part, as at *A*, the radius of the half-bore can be measured by the use of an inside micrometer in connection with the gage piece *B*. The gage piece is a piece of flat steel bent to the shape shown and is attached to the boring bar opposite the cutting point of the toolbit, the boring bar being held in the toolpost of the lathe. The faces *C* and *D* of the gage piece are accurately the same distance from the surface of the boring bar and are parallel with it. After attaching the gage piece to the boring bar, its face *C* is filed to leave a narrow bearing strip along its middle, as at *F*, and a cross-hole *H* is drilled in the boring bar to admit the spindle of the inside micrometer.

In use, the lathe spindle is turned to bring the half-bore to the back, as at *I*, and the carriage is run to the left far enough to bring face *C* of the gage piece within the half-bore. The toolblock is then adjusted on the cross-slide to bring face *C* of the gage piece into light contact with the half-bore and the inside micrometer spindle is inserted in hole *H*. The lathe spindle is then turned to bring the half-bore to the front, as at *K* and the carriage is run farther to the left to bring the whole of the inside micrometer inside the half-bore. With the spindle end of the inside micrometer in contact with face *D* of the gage piece and the thimble end in contact with the half-bore, the dimension read on the micrometer will be twice the radius of the half-bore.



With an inside micrometer used in connection with the gage piece, as described, the radius of the half-bore can be accurately determined

Machinability And Piece Rates

By JAMES SORENSON and WALLACE GATES
Chief Metallurgist and Head of Standards Department
Four Wheel Drive Auto Company

MACHINABILITY ratings can be put to considerable use in the machine shop. They are valuable guides in selecting materials from a cost standpoint; they have a very practical application in setting rates or standards for machining operations; and they can be used when estimating machining times for new jobs or proposals. Usually there is no data available on which the machining qualities of a given steel can be judged. For that reason we have been collecting data for several years on the machinability of the steels used in our shops.

The principal factors to be considered in determining the rate at which various steels can be machined are ductility, strength and the effect of *ferrite* in steels having less than 0.30 per cent carbon. Ductility, as indicated by per cent elongation, controls the extent to which the chips will cling to the tool. Strength of the steel, as indicated by tensile or hardness values, affects the power required to thrust the cutting tool under the chip. Low ductility means less interference because of chips "balling" up in the tool, while low tensile strength will indicate that less power input will be required.

In steels below 0.30 per cent carbon, where the sulphur and phosphorous content is below 0.06 and 0.05 per cent respectively and where no other element such as lead has been added to give free machining properties, the soft, ductile ferrite is a sticky, gummy constituent which is difficult to cut. The amount of the free ferrite constituent increases with decreasing carbon content. Hence, the effect of chips balling up on the tool and causing the material to tear, thus increasing the difficulty of obtaining a good surface finish, will increase as the carbon content is lowered in low carbon steels.

Based on this reasoning, and using standard test pieces of several steels of known composition and physical characteristics, a tentative range of machinability ratings was established. These were checked against several years of actual production experience on a wide variety of work, using 18-4-1 high-speed steel tools and average machine tool equipment. The results shown in the accompanying reference book sheet on page 921 are set up with S.A.E. 1112 free-cutting Bessemer steel representing 100 per cent machinability.

Being based on the average amount of material removed in normal production, no correction need be made in these relative machinability values for cutting lubricant, operator or other variable or unknown factors. The relative machinability ratings indicate results which should be obtainable in the average shop.

There are several ways in which these ratings may be used to determine machining allowances or standards. The method we are using in our standards department is demonstrated in the accompanying curves. For convenience, we have established a system of machinability numbers in which each number represents a material which is rated as five per cent more or less machinable than the next number below or above, respectively. These rating numbers were set up by having the number 46 represent 100 per cent machinability and assigning successive numbers. The complete list is given in the accompanying table.

With the machinability table at hand, it is not necessary to make a great many feed-speed tests on each type of operation to obtain a complete coverage of all of the materials that may be run on a particular type of operation. It is necessary only to experimentally spot check the speeds and feeds on one or two materials, establish the relation between feeds and depths of cut, and, remembering that machinability is an index to metal re-

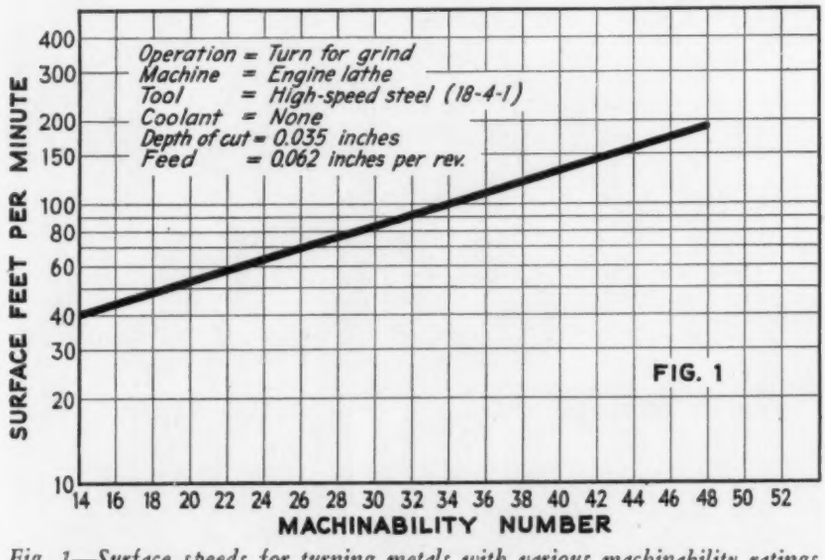


Fig. 1—Surface speeds for turning metals with various machinability ratings are indicated above for a semi-finish turning operation under standard conditions in an engine lathe

Relative Machinability of S.A.E. Steels

By JAMES SORENSON and WALLACE GATES

USING STANDARD test pieces of various steels of known composition and physical characteristics, and then checking the test results with several years production experience on a wide variety of work, the following machinability ratings have been determined for S.A.E. steels. These results are based on the use of 18-4-1 high-speed steel tools in average production-type machine tools. The relative per cent machinability rating has been set up with S.A.E. 1112 free-cutting Bessemer steel representing 100 per cent machinability.

Since they are based on metal removal in normal production work, no correction is necessary for changes in variable or unknown factors. The ratings represent results which should be obtained without difficulty in the average shop.

Machinability numbers assigned to the various steels are selected according to a method explained on the preceding pages. With these data it is necessary only to spot check the feeds and speeds best suited for a given operation on one or two steels, and then determine graphically the proper speeds and feeds for other steels on the list.

NOTE: In columns headed "Treat"—"Ann" means Annealed; "No" means No Heat-Treatment or "As Rolled"; "Yes" means Heat-Treat, Quench and Draw. Machinability ratings and Brinell hardness values should not be considered as absolute, but rather as guides to what can be accomplished with average fabricating equipment. This table is intended primarily for use in connection with high-speed steel (18-4-1) cutting tools.

Machinability Numbers

Per Cent	Number	Per Cent	Number	Per Cent	Number
97–102	46	58–60	35	35–36	24
93–96	45	56–57	34	34	23
89–92	44	54–55	33	32–33	22
84–88	43	51–53	32	31	21
81–83	42	49–50	31	29–30	20
77–80	41	47–48	30	28	19
74–76	40	45–46	29	27	18
71–73	39	43–44	28	26	17
67–70	38	41–42	27	25	16
64–66	37	39–40	26	24	15
61–63	36	37–38	25	22–23	14

S.A.E. Spec.	Process of Manufacture	How Finish Rolled	Treat	Brinell Hardness	Per Cent Machinability	Machinability Number
STRAIGHT CARBON STEELS						
1010	O.H.	Cold	No	124	50	31
1010	O.H.	Hot	No	109	44	28
1020	O.H.	Cold	No	146	58	35
1020	O.H.	Hot	No	128	52	32
X1020	O.H.	Cold	No	165	68	38
X1020	O.H.	Hot	No	137	62	36
1030	O.H.	Cold	No	179	66	37
1030	O.H.	Hot	Ann.	149	65	37
1030	O.H.	Hot	Yes	192	58	35
1035	O.H.	Cold	No	183	64	37
1035	O.H.	Hot	Ann.	163	64	37
1035	O.H.	Hot	Yes	212	50	31
1040	O.H.	Cold	No	207	62	36
1040	O.H.	Hot	Ann.	179	63	36
1040	O.H.	Hot	Yes	235	47	30
X1040	O.H.	Cold	No	212	60	35
X1040	O.H.	Hot	Ann.	185	62	36
X1040	O.H.	Hot	Yes	241	45	29
1095	O.H.	Hot	Ann.	207	43	28
NICKEL STEELS						
2315	O.H.	Cold	No	187	50	31
2315	O.H.	Hot	Ann.	159	51	32
2315	O.H.	Hot	Yes	228	46	29
2320	O.H.	Cold	No	202	52	32
2320	O.H.	Hot	Ann.	166	54	33
2320	O.H.	Hot	Yes	235	45	29
2330	O.H.	Cold	No	223	48	30
2330	O.H.	Hot	Ann.	179	56	34
2330	O.H.	Hot	Yes	285	33	22
2340	O.H.	Cold	No	235	46	29
2340	O.H.	Hot	Ann.	201	51	32
2340	O.H.	Hot	Yes	302	28	19
2350	O.H.	Cold	No	293	39	26
2350	O.H.	Hot	Ann.	217	45	29
2350	O.H.	Hot	Yes	321	23	14
2515	O.H.	Cold	No	235	45	29
2515	O.H.	Hot	Ann.	163	42	27
2515	O.H.	Hot	Yes	241	35	24
LOW CHROME NICKEL STEELS						
3120	O.H.	Cold	No	201	54	33
3120	O.H.	Hot	Ann.	146	58	35
3120	O.H.	Hot	Yes	235	45	29
3130	O.H.	Cold	No	223	52	32
3130	O.H.	Hot	Ann.	197	56	34
3130	O.H.	Hot	Yes	255	42	27
3140	O.H.	Cold	No	235	50	31
3140	O.H.	Hot	Ann.	207	55	33
3140	O.H.	Hot	Yes	286	37	25
X3140	O.H.	Cold	No	241	50	31
MEDIUM CHROME NICKEL STEELS						
3220	O.H.	Cold	No	207	50	31
3220	O.H.	Hot	Ann.	185	52	32
3220	O.H.	Hot	Yes	255	40	26
3230	O.H.	Cold	No	235	47	30
3230	O.H.	Hot	Ann.	207	50	31
3230	O.H.	Hot	Yes	277	35	24
3240	O.H.	Cold	No	248	41	27
3240	O.H.	Hot	Ann.	212	43	28
3240	O.H.	Hot	Yes	285	32	22
3250	O.H.	Hot	Ann.	228	40	26
3250	O.H.	Hot	Yes	302	29	20

S.A.E. Spec.	Process of Manufacture	How Finish Rolled	Treat	Brinell Hardness	Per Cent Machinability	Machinability Number
HIGH CHROME NICKEL STEELS						
3312	O.H.	Hot	No	241	44	28
3312	O.H.	Hot	Ann.	192	48	30
3312	O.H.	Hot	Yes	277	40	26
3340	O.H.	Hot	Ann.	228	41	27
3340	O.H.	Hot	Yes	302	26	17
CHROME NICKEL MOLY STEEL						
4340	Elec.	Hot	Ann.	228	55	33
4340	Elec.	Hot	Yes	255	42	27
4340	Elec.	Hot	Yes	293	39	26
4340	Elec.	Hot	Yes	331	36	24
4340	Elec.	Hot	Yes	375	26	17
NICKEL MOLY STEELS						
4615	O.H.	Cold	No	197	64	37
4615	O.H.	Hot	Ann.	149	62	36
4615	O.H.	Hot	Yes	235	54	33
4620	O.H.	Cold	No	207	66	37
4620	O.H.	Hot	Ann.	163	64	37
4620	O.H.	Hot	Yes	248	52	32
4640	O.H.	Hot	Ann.	207	60	35
4640	O.H.	Hot	Yes	293	44	28
4640	O.H.	Hot	Yes	321	39	25
CHROME MOLY STEELS						
4130	O.H.	Cold	No	212	56	34
4130	O.H.	Hot	Ann.	179	58	35
4130	O.H.	Hot	Yes	277	40	26
4140	O.H.	Cold	No	248	52	32
4140	O.H.	Hot	Ann.	183	55	33
4140	O.H.	Hot	Yes	285	38	25
4150	O.H.	Cold	No	269	46	29
4150	O.H.	Hot	Ann.	197	52	32
4150	O.H.	Hot	Yes	302	34	23
CHROME STEELS						
5140	O.H.	Hot	Ann.	207	50	31
5140	O.H.	Hot	Yes	269	38	25
52100	O.H.	Hot	Ann.	228	35	24
CHROME VANADIUM STEELS						
6120	O.H.	Cold	No	207	52	32
6120	O.H.	Hot	Ann.	163	54	33
6120	O.H.	Hot	Yes	228	46	29
6130	O.H.	Cold	No	228	54	33
6130	O.H.	Hot	Ann.	179	56	34
6130	O.H.	Hot	Yes	277	35	24
6135	O.H.	Cold	No	241	49	31
6135	O.H.	Hot	Ann.	185	55	33
6135	O.H.	Hot	Yes	286	33	22
6135	O.H.	Hot	Yes	321	29	20
6140	O.H.	Hot	Ann.	201	52	32
6150	O.H.	Hot	Ann.	207	47	30
SILICON MANGANESE STEELS						
9255	O.H.	Hot	Ann.	224	40	26
9260	O.H.	Hot	Ann.	235	35	24
FREE CUTTING STEELS						
1112	Bess.	Cold	No	174	100	46
1120	O.H.	Cold	No	165	82	42
1120	O.H.	Hot	No	137	76	40
X1315	O.H.	Cold	No	170	94	45
X1315	O.H.	Hot	No	149	88	43
X1335	O.H.	Cold	No	212	65	37
X1335	O.H.	Hot	Ann.	201	60	35

moval, determine graphically proper speeds and feeds for the other materials.

For example, Fig. 1 shows the relation between surface speed in feet per minute and machinability for semi-finish turning prior to finish grind on an engine lathe using a high speed steel tool with no coolant at 0.035 in. depth of cut and 0.062 in. feed per revolution. With this curve machining times readily can be calculated for various lengths of cut in various materials. Of course, feed must be varied for different depths of cut and finishes desired.

Fig. 2 is similar to Fig. 1, except that it is for turning with a box tool on a small screw machine. Three hours of actual cutting time is the standard tool life for these values. Fig. 3 shows another variation where machinability numbers are plotted against the time required to drill a center hole. In this instance we are dealing with a condition where many factors are constant. The hand-fed centering drill is employed in drilling a constant size center hole, and the machine has a fixed or constant r.p.m. Since all of these conditions are constant, the time varies only with change in materials.

Similarly we have applied the machinability table to many other machining operations with considerable success. It must be remembered that the actual values of surface feet per minute and the time found in these examples (Figs. 1, 2, and 3) have proven accurate in our shop, but may have to be altered to fit conditions existing in other places. However, such adjustments can be made merely by raising or lowering the lines and keeping the slope constant.

For one group of machines we have used the machinability table as a guide to relative amounts of power required to remove a given amount of metal per minute and, inversely, the relative amount of metal that can be removed per minute with a given amount of power. This guide is valuable when setting rates or standards on a machine where the power available is a limiting factor on feeds and speeds.

After having determined and prepared machinability data of this sort it is possible to calculate machining times and to establish standards or piece rates based on the type and the amount of metal to be removed for almost any machining operation. Curves of machinability number versus one of the three variables—surface speed, volume of metal removed, or time—can be established for nearly every machine in the shop after only a few check tests on each type of operation. Once they have been drawn up and arranged for ready reference, calculation of the machining portion of piece rates is a fairly simple operation.

Many shops have high production jobs that are run on special or heavy-duty machines where both the quantity and the nature of the operation warrant the use of tantalum carbide, tungsten carbide or other special tools. With such tools very high surface speeds are obtainable and the machinability ratings are of little use. However, where shops work on small quantities and a large variety of jobs, and where high speed steel cutting tools are used, it is our experience that a relative machinability table is most valuable.

Since the ratings have all been determined relative to production results on S.A.E. 1112 steel, the machinability percentages should not be much different for any other shop. If the type of machine is different, or the volume of metal removed in a given time is more or less, there should be only a shift in the base line, but no particular change in the relative machinability of the materials.

Of course, in shops practices and methods may necessitate a change in some of the figures, but from our experience, after a long period of use of the table, such changes should not be large.

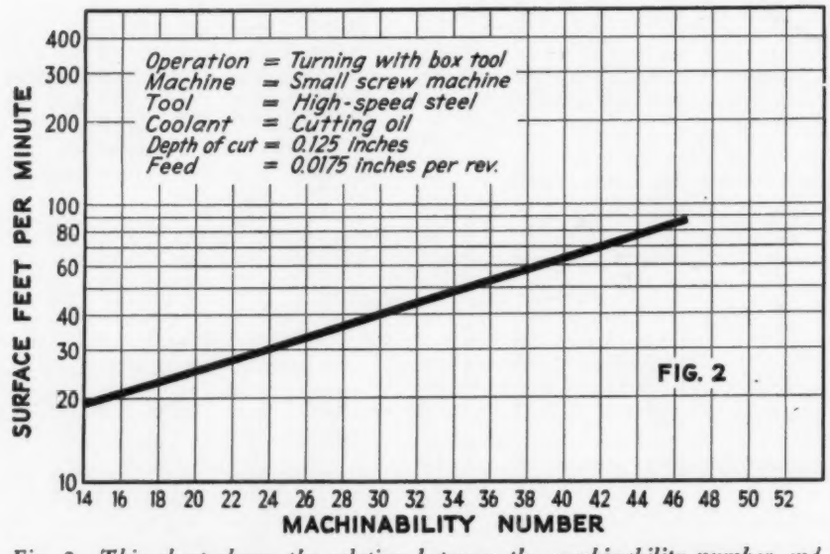


Fig. 2—This chart shows the relation between the machinability number and surface speed when turning with a box tool in a small screw machine

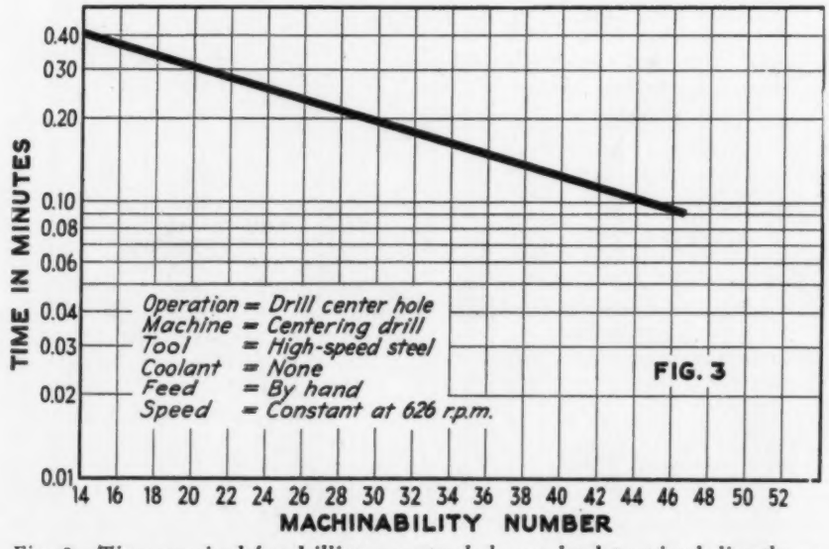


Fig. 3—Time required for drilling a center hole can be determined directly, as most of the factors involved are constant

Sowing Skill

UNLESS you have been hibernating like Rip Van Winkle, you have heard much about the paradox of scarcity amid plenty. Nowhere is it more striking than in the supply of trained factory workers.

Although about nine million men are still unemployed in the United States, it is often difficult to find satisfactory persons for specific skilled jobs. And that goes for factory positions, such as machinists and tool makers, as well as for white collar jobs.

This brings me to the point that many metal-working companies, faced with rapidly expanding operations, wish today that they had a reservoir, in the form of an apprentice training system, to draw upon.

It's hardly necessary to say that a good tool maker or a skilled machine operator usually has a good job. His job is far less likely to be washed out by depression rains than the job of the unskilled worker.

But such skill cannot be acquired overnight. It cannot be acquired, in fact, in a few weeks or months. It calls for long-term study and shop training under adequate supervision. It is like getting a college degree in the shop.

Few companies have taken hold of apprentice training on a consistent year-in-and-year-out basis. It has been mostly a "fair weather" project. When the business curve creeps up and skilled men are needed, as at present, apprentice training is taken out of the closet and the moth balls removed. By the time the first graduates are taking their place in the shop, the business curve is trending downward. Then the training course is likely to sink into disuse, because management feels it cannot afford this expense during dull times.

Now the truth is it would be better to reverse the usual cycle. When business is poor, the policy should be to prepare for good times. It is then that apprentices should be trained so that they will be ready when their services are really needed.

But still better than reversing the cycle is to install a training program which won't be subject to the fickle changes of the business weather, one which won't be abandoned the minute the warning flag of an approaching storm is hoisted.

Some companies and some communities have long been committed to such a program, but they are all too few in number. Brown & Sharpe has a training system much publicized and among the best known in the metal-working industry. Up in Springfield, Vt., Jones & Lamson, Fellows and Bryant have supported a plan tied in with the local public schools. It has been going since 1913 and is a good example of what can be done continuously through prosperity and depression.

The problem should be approached scientifically, not haphazardly. A company should find out what its average shop replacements are each year and arrange a training plan to take care of at least part of its annual needs.

Among others, the War Department is encouraging industry to train men because it is concerned about a potential shortage of skilled workers in case the United States should ever become involved in war. But there are more immediate and pressing reasons why management should begin now. Training systems provide not only highly skilled men who are indispensable in the shop, but also future foremen, superintendents and managers.

Money spent on training apprentices is money well spent. It is a proved way of insuring a company a necessary supply of skilled master craftsmen. And if American industry is to retain its supremacy, it must not permit the trade of all-round machinist and tool maker to become a lost art.

Burnham Finney

GAGING BUSINESS

Metal-working activity continues to increase, with plants making peacetime goods also prominent in the upswing. Still greater production expected with repeal of arms embargo.

The metal-working industry has further broadened its operations the past fortnight. Many manufacturers are running 24 hours a day in most departments. To find factories on less than two shifts five or six days a week is the exception rather than the rule. Though a large part of the present prosperity stems from the war or from the government's national defense program, much of the current activity is in plants making solely peacetime goods. Upon repeal of the Embargo Act, a spurt in war products, particularly aircraft, is certain. Metal-working companies received contracts from the Federal government amounting to over $18,000,000 the past week.

MACHINE TOOLS—Biggest problem of machine tool builders today is to squeeze out just as much production as possible to meet the unprecedented demand. Sales have leveled off on a high plateau following the September climb to an all-time peak. Domestic bookings have been heavy and remarkably well diversified. Among buyers have been manufacturers of automobiles, farm implements, cranes, plumbing goods, diesel engines, electric motors, mining machinery, ball bearings, railroad cars and airplanes. Orders from aircraft concerns have been especially good. Machine tool builders themselves, in their efforts to increase output, have been substantial buyers of machine tools. Purchases by England, France, Japan and Soviet Russia have been steady. Inquiries from abroad continue in undiminshed volume. The delivery situation, if anything, is worse. Some types of machines cannot be secured until the final months of 1940 or the first quarter of 1941. Dealers in the East have been the busiest in the country the past month, but the wave of business recently has spread to dealers in the Middle West. A number of machine tool makers have been holding their own shows at their plants the past few weeks to demonstrate newly-designed equipment.

AGRICULTURAL IMPLEMENTS—Production is being stepped up as dealers' stocks and factory inventories are built up in anticipation of spring sales of tractors and tillage equipment. Strikes in radiator manufacturing plants have interfered to some extent with tractor output.

MATERIALS HANDING EQUIPMENT—Sales have shown a sharp upturn. Some makers of hoists report recent orders have been among the best in history. Industrial truck companies are doing well. Conveyor manufacturers say their business is fairly good.

POWER PLANT EQUIPMENT—Utility companies have loosened their purse-strings with the result that orders for electrical machinery and for steam turbines have been much better.

FOUNDRY EQUIPMENT — Production has been increased to take care of the influx of orders. Total business is far above the volume of a year ago.

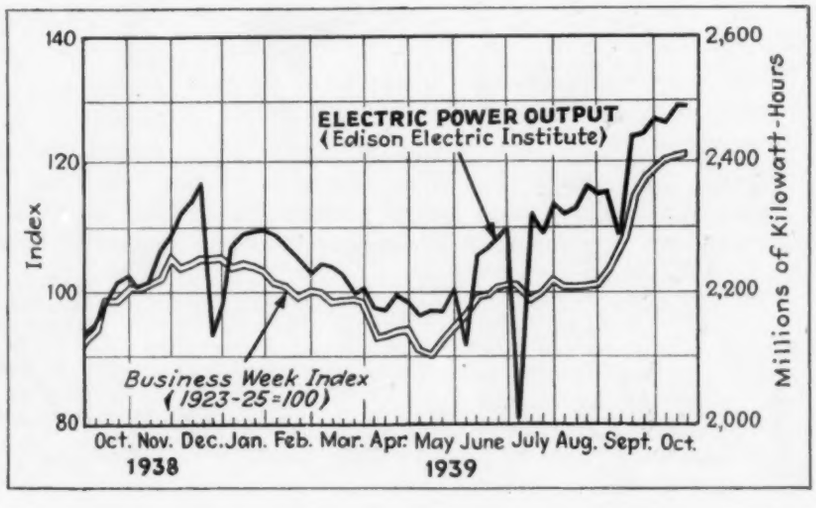
STEEL—Though mills are running above 90 per cent, most steel being delivered to customers is being immediately fabricated. Users won't be able to accumulate inventories until toward the year-end, if then. First quarter orders are piling in unsolicited in considerable volume. Some steel consumers, as is their custom in rush periods, are sending representatives to the mills to press for speedier deliveries. Should domestic demand ease soon, a sizable unsatisfied foreign market remains to be tapped.

RAILROAD EQUIPMENT — Employment of railway equipment makers in the Chicago district has risen above 15,000 men from a depression low of 5,000. Plants of the Pullman Co. are approaching a full-capacity schedule. In fact, the Hammond works, closed since 1933, may be reopened soon. Brazil has ordered 17 locomotives and 1,000 cars at a cost of about $6,000,000,000. The Baltimore & Ohio has bought 1,000 cars from Bethlehem and 500 from American Car & Foundry; Northern Pacific 650 from American Car & Foundry, 500 from Pullman and 50 from General American Transportation.

AIRCRAFT—The industry continues to operate close to capacity with record backlogs. Douglas is boosting its payroll by 2,500 men to a total of 12,000. If and when the embargo is repealed, large orders for planes will be placed immediately in this country by the British and French. Pratt & Whitney Aircraft and Curtiss-Wright are speeding factory expansion.

POWER CONSUMPTON VS. GENERAL BUSINESS

Production has lost no time in keeping up with the accelerated tempo of general business, as consumption of electric power proves



NEWS OF THE INDUSTRY

JAPANESE RUSH MACHINE TOOL BUYING AS TREATY EXPIRES

TOKYO—Japan has placed large orders for machine tools in the United States. The reason for the buying rush apparently is as a protection against the possibility that a new trade agreement may not be reached immediately upon expiration of the present treaty in January.

Whether Japan will find it necessary because of lack of exchange to curtail its purchases in the United States is not yet known. An encouraging development has been her action the past week in pegging the yen to the American dollar instead of to the British pound. That is an indication of Japan's intention to keep trading with the United States on as large a scale as possible.

Though Japan may have to decrease her total purchases in the United States, it is believed that machine tools will be near or at the top of her priority list. If necessary, she probably will forego buying non-essentials and concentrate on such essentials as machine tools.

There is good grounds for this belief. The United States, Germany, England, France and Switzerland in recent years have provided nearly all the machinery for Japan. Germany is physically unable to make deliveries, England and France will be buyers rather than suppliers, and Switzerland has no shipping facilities. This means that what machine tools Japan gets from abroad must come from the United States. It is believed, however, that changes resulting from the war will seriously retard Japan's program in Manchuria.

This applies in particular to large automobile and aircraft projects. Two huge government-controlled corporations, capitalized at some $23,000,000 and $7,000,000 respectively, had been assured on their establishment that the needed machine tools would be supplied by Germany. Several executives, sent to Germany by way of the United States to pick up some U. S. specialties, are now making a second round of American plants. They can't possibly buy anything, but it would not be surprising to hear in the next few weeks that Manchukuo wants American credits. Previous attempts at securing American investment capital for Manchurian motor projects have all fallen flat, and officials here admit this is not a very propitious moment for a credit deal either.

Canada Resists Pressure to Expand Industry; Greater Business for United States Probable

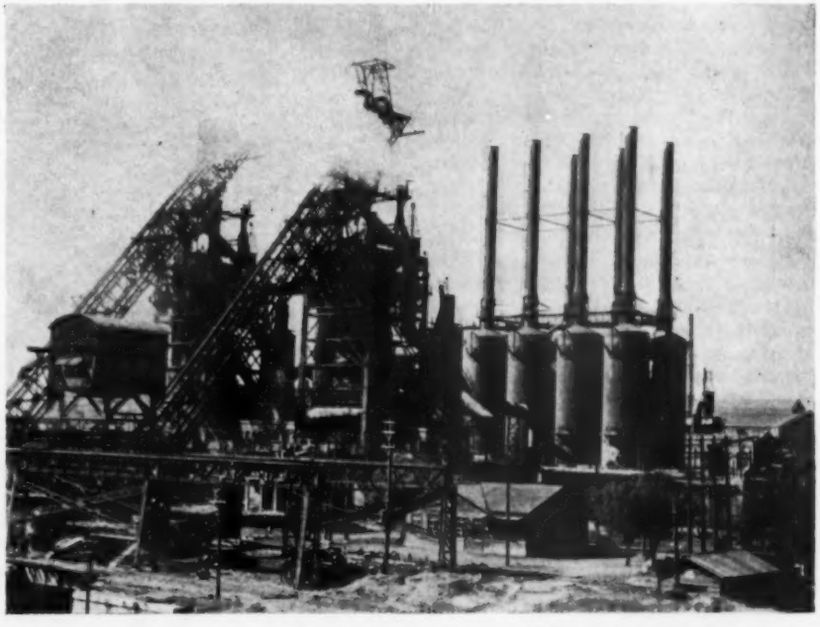
Neutrality Act Revision Would Prevent Mushroom Growth of Dominion's Manufacturing

OTTAWA—Despite tremendous pressure, Canada doesn't want to undergo a huge industrial expansion to transform herself into the Allies' arsenal —she would much rather buy from the United States. Such is the feeling of most Canadian industrialists, at any rate, and it gives promise of an even greater business volume in the United States than if Canada were simply to buy equipment below the border to expand her own plants.

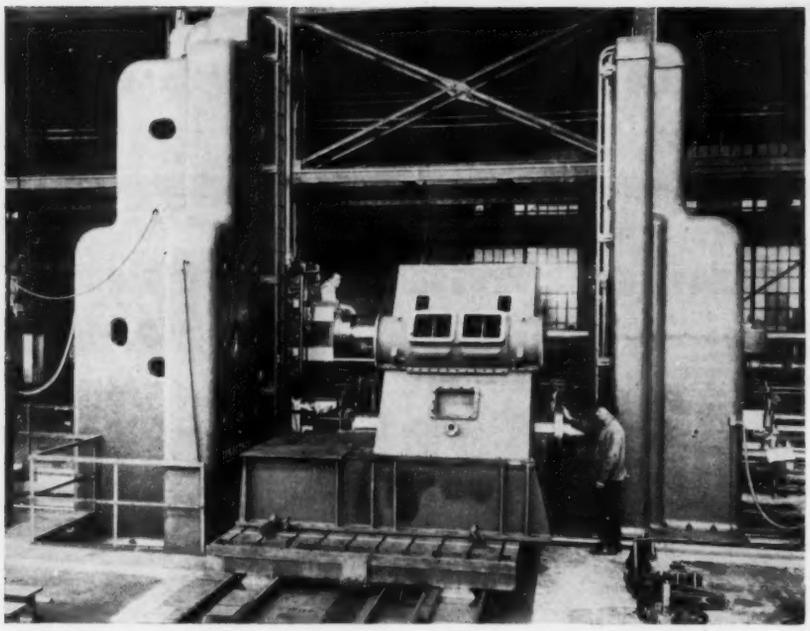
Chief obstacle, of course, is the present neutrality law. Its repeal would throw much Canadian business to the United States—business which Canada would be only too glad to place outside her own borders, as she is already assured of more war orders than she can handle. Failing neutrality law revision, it is believed

ALLIES TO PLACE BIG BUSINESS

WASHINGTON — British and French buying missions, now in the United States seeking to purchase aircraft and machinery for making planes, expect to pounce upon available goods and future production facilities as soon as the embargo is repealed. Repeal appears likely by the end of this week. To avoid embarrassing the administration and jeopardizing passage of the bill, they temporarily are lying low. In fact, American machine tool and machinery makers are trying to find them. Latest check-up reveals that sale of production machinery to the allies will not reduce their demands for finished planes and for munitions.



Flop—*Heart and soul of Manchukuo's five-year plan of industrial expansion is the Showa Steel Works at Anshan. Collapse of barter agreements with Germany leaves Manchukuo with no machinery to complete the plan. Little can be secured from America because of the devaluated yen and scarcity of credit*



Versatile—*Mammoth horizontal boring and milling machine installed in the South Philadelphia works of the Westinghouse Electric & Mfg. Co. handles huge castings for boring and facing operations. It weighs some 400,000 lb. and comprises a head column carrying the saddle, a bed carrying the table, and an outboard column, interlocked mechanically and electrically. Above, pinion bearing housings are bored in the main gear case of a 6,000-hp. marine unit*

short-notice orders for lathes to make shell cases in Canadian factories. While no large shell orders have been placed by Britain or Canada yet, manufacturers have good reason to expect such orders soon and have been tooling up their plants in advance. As a result of failure to arrange for quick production of lathes below the border, orders are expected to go to a few Canadian plants only. Such firms in line for shell orders as Canadian Car & Foundry and National Steel Car can equip themselves with lathes. Shell orders in large volume are also likely to go to such companies as Dominion Bridge and Canadian Bridge.

Delay in placing orders by both Canada and Britain is causing considerable dissatisfaction among industrial leaders. Main cause is believed to be London's uncertainty as to the type of equipment the Allies need most, and as to the needs which can be filled in the United States when the neutrality law is repealed.

Canada is also intensely interested in the shipping crisis precipitated by the war. Plans are under way for construction of many types of vessels, both naval and merchant, in Canadian yards.

that assurance of large British and French orders would induce U. S. manufacturers to establish temporary branches in Canada, and this is not considered in her best long-term interests as their abandonment at the end of the war would create serious economic difficulties.

Potentially one of the most striking business developments is London's decision to make Canada the Empire's air force training center. Plan would cost about $700,000,000 annually, and would provide 10,000 trained pilots and produce some 1,200 training planes a year. At the beginning, training ships would be bought in the United States, neutrality law revision permitting, but domestic manufacture would be pushed.

In anticipation of a favorable outcome of the neutrality law issue, representatives of the British war missions in Canada have been traveling extensively in the United States looking into the prospects of placing war equipment orders. Airplanes are their first concern, but they are also vitally interested in rail transport facilities from U. S. industrial centers to Canadian ports, with a view toward safer and cheaper transport of American-made products to the Allies via Canada. Shipment of goods from Montreal by the St. Lawrence route, for instance, would cut off nearly 1,000 miles of open ocean voyage in which convoy would be necessary.

Unsuccessful efforts have been made to place in the United States

U. S. Government Contracts Awarded to Metal-Working Firms

(Last-minute awards on page 922b)

Contractor	Gov't Agency	Commodity	Amount
Copperweld Steel Co., Glassport, Pa.	War, Engineer	Wire fabric	$141,350
American Bridge Co., Gary, Ind.	Interior	Drum gates	609,360
Columbian Steel Tank Co., Kansas City, Mo.	Agriculture	Grain bins	415,000
A. N. Eaton Metal Products, Omaha, Neb.	Agriculture	Grain bins	86,190
Stefco Steel Co., Michigan City, Ind.	Agriculture	Grain bins	83,880
Perfection Steel Body Co., Galion, Ohio	Agriculture	Grain bins	169,750
Martin Steel Products Cor., Mansfield, O.	Agriculture	Grain bins	257,530
Aluminum Co. of America, Pittsburgh, Pa.	War, Navy	Aluminum	347,703
Davenport Mach. Tool Co., Rochester, N. Y.	War, Ordnance	Screw machines	42,793
Thompson Grinder Co., Springfield, Ohio	War, Ordnance	Surface grinders	14,340
Ace Drill Co., Detroit, Mich.	War, Air Corps	Twist drills	15,140
Wm. Sellers & Co., Philadelphia, Pa.	Navy, S. & A.	Planer	23,416
Gisholt Machine Co., Madison, Wis.	Navy, S. & A.	Lathes	12,678
Rockford Machine Tool Co., Rockford, Ill.	Navy, S. & A.	Planer	22,251
Consolidated Machine Tool Corp., Rochester, N. Y.	War, Ordnance	Boring mill	174,825
Buffalo Forge Co., Buffalo, N. Y.	Navy, S. & A.	Ventilating equipment	125,070
Allis-Chalmers Mfg. Co., Milwaukee, Wis.	Interior	Circuit breakers	647,942
Phelps Dodge Copper Products Corp., Habirshaw Cable & Wire Div., New York, N. Y.	Panama Canal; Navy	Insulated cable	90,888
National Electric Products Corp., Economy, Pa.	Navy, S. & A.	Electric cable	94,835
American Steel & Wire Co., Worcester, Mass.	Navy, S. & A.	Cable	210,182
Railway & Industrial Engineering Co., Greensburg, Pa.	Interior	Bus structures	370,000
Worthington Pump & Machinery Corp., Harrison, N. J.	Interior	Pumping units equipt.	104,947
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.	TVA, Int., CAA,	Electrical	137,096
Moloney Electric Co., St. Louis, Mo.	TVA	Transformers	124,189
Lockheed Aircraft Corp., Burbank, Calif.	TVA	Airplanes	51,064
United Aircraft Corp., Pratt & Whitney Aircraft Dv., East Hartford, Conn.	Navy, S. & A.	Airplanes	929,074
United Aircraft Corp., Hamilton Standard Propellers Div., East Hartford, Conn.	War, Air Corps,	Propeller parts	47,950
Sperry Gyroscope Co., Brooklyn, N. Y.	Navy, S. & A.	Gyroscopes	201,600
RCA Mfg. Co., Camden, N. J.	Navy, S. & A.	Motion picture equipt.	54,547
Scovill Mfg. Co., Waterbury, Conn.	War, Ordnance	Cartridge cases	302,937
General Motors Corp., Cleveland Diesel Engine Div., Cleveland, Ohio	Navy	Submarine propelling machinery	2,606,001
Fairbanks, Morse & Co., Chicago, Ill.	Navy	Submarine propelling machinery	2,824,575
American Locomotive Co., Auburn, N. Y.	Navy	Submarine propelling machinery	419,750
Timken-Detroit Axle Co., Oshkosh, Wis.	War, Ordnance	Power trains	397,205
Teletype Corp., Chicago, Ill.	War, Signal Corps	Teletype machines	213,052
Douglas Aircraft Co., El Segundo Div., El Segundo, Calif.	Navy, S. & A.	Airplanes	716,900
Curtiss-Wright Corp., Curtiss Propeller Div., Clifton, N. J.	Navy, S. & A.	Propeller assemblies	134,822

WATCHING WASHINGTON

McGraw-Hill Washington Bureau

PAUL WOOTON, CHIEF

Though being soft-pedaled, defense activity is going forward at an ever-increasing pace. Attention centers on prospects of neutrality law revision.

WASHINGTON—Army and Navy are working pianissimo on prepardness. The Administration ordered the soft pedal to avoid any public excitement which might jeopardize the bill for repeal of the embargo. It is expected that as soon as repeal is accomplished, which the Administration confidently expects, the ban will be off and Louis Johnson & Company can talk war again. Unless strongly backed criticism pipes them down or even blasts Johnson out. Unexpected House opposition to embargo repeal might delay action till mid-November or later.

Meanwhile Washington is coolly intent on oiling its guns. The War Department is pushing the 1939 mobilization plan, rushing arms orders under present appropriations, drafting further air and mechanization expansion for proposal to Congress, preparing to increase personnel to full peacetime strength. Navy is being quietly reorganized, and the President almost certainly will ask next session to increase the establishment. Thus the Government is making ready for peace with its legislative arm and for war with its administrative arm, and trying to keep a straight face before the democratic press.

Aim for Centralized Shipbuilding Authority

As efficiency in Naval shipbuilding becomes more important due to cost and the urgency of expansion, there is more pressure for reorganization to centralize authority. At present the Bureau of Construction and Repair designs ships' hulls, Bureau of Engineers their engines, Bureau of Ordnance their armor and guns. Other overlapping puts authorities in each other's way. Acting Secretary Edison has virtually combined BCR and Engineering. Whether he can get away with what he has done, and more that he plans to do, without congressional action, is a question: If Congress gets busy with the expansion which Roosevelt may propose, it will not want to revise the rules in the middle of the game.

Snatch at South American Trade

State Department's move to complete a trade agreement with Argentina is regarded here as the kickoff in a campaign to take over Germany's trade in South America. In 1938 the Germans sold to the Latins $34,000,000 worth of machinery for metalworking, textiles, commercial sewing, food processing, printing, and diesel engines. To get the business we will have to give them a better trade balance than they now have with us. They have a good balance with Germany.

Unhappy New Year

Wage-hour "New Years" was 12:01 Oct. 23 and Lt.-Col. Philip Fleming is the Administration's resolution. With 13,000 complaints of violation of the 25c minimum wage piled on his desk, Fleming will undertake to build up compliance among employees, whose incentive to break the law is now increased by five cents an hour and two hours a week. The new Administrator is a highly competent but considerate and patient trouble-shooter for FDR. Secretary Perkins liquidated Andrews because she couldn't manage him. Whether she can control Fleming remains to be seen. There will be a row in Congress sooner or later over legality of Fleming's appointment and over Perkins' usurpation of authority. The law says the Wage-Hour Division is independent of the Secretary.

NO SKILLED LABOR?

WASHINGTON—Authorities here privately regard tool and die maker shortage as the most serious labor bottleneck in any emergency. The War Department has a last-report solution up its sleeve. Automobile manufacturers could be asked not to change models. It is said this would release 1,500 to 2,000 men, and that standardization of cars for two or three years would do no harm to anybody.

In a letter coaching manufacturers on the mobilization plan, the War Department advised them, among other things, to maintain apprenticeship programs which will create a "reservoir" of labor. A reservoir holds something for future use and in this case it means unemployed men. This, and constant official statements that a skilled labor shortage exists, moved AFL's International Association of Machinists to cut loose a strong reiteration that 20,000 of its members are available. This discrepancy would be an important factor in the final showdown on labor's place in mobilization of industry.

Millions for Moving

Industry at the close of third quarter 1939 had made 17,017 contracts valued at $1,301,354,306 under the Walsh-Healey law since it became effective Sept. 28, 1937. Biggest item by far of federal purchase was transportation equipment: $519,764,024, or 40% of the total. Iron and steel products totaled $94,271,732 or 7.24%. Other machinery, $86,120,099 or 6.62%. Non-ferrous metals and alloys, 1.73%. By pegging wages for public contract workers the government of course adds the overplus to taxes. CIO will try again next session to reduce the $10,000 minimum to $2,000 and to blacklist violators of the Wagner Act.

Department of Commerce to the Fore

Department of Commerce has been a mere bookkeeper on a high stool ever since its glory departed with President Hoover. FDR never wanted it to go ahead—till now. And even now it will shine under the War Department's bushel. Secretary Hopkins has orders to coach business in compliance with the intricacies of the mobilization plan. Tunes in nice with the Administration's war dance because it sounds peaceful.

War Dance Sidelights

Present neutrality law threatens Canadian air lines with shutdowns; they got U. S. propellers, engines and parts till they were cut off as belligerents. . . . War Department has proposed a new contract form which would enable Department to determine "fair and reasonable" prices (World War plan was cost plus six per cent, with manufacturer doing the figuring). New form would permit manufacturer to recover losses if he can prove it by arbitration. . . . FDR says his warning stopped foreign efforts to interfere with our accumulation of strategic materials. . . . His promise not to interfere in embargo legislation is being taken so literally on the Hill that State Department is not asked for advice and many blunders will result. Administration did not write the neutrality bill, as commonly supposed; it was written on the Hill. . . . Fears of U-boat attacks on American shipping if arms embargo is repealed are over-emphasized; few people stop to think that Germany wants to keep the U. S. out of the war at all costs.

Medal Winners—*Miller medal, donated by the American Welding Society to commemorate the contributions of Samuel Wylie Miller to the science of welding, was presented to C. J. Holslag, extreme left, by Dr. Comfort A. Adams, a past president of the society. Charles H. Jennings, extreme right, presented the Lincoln Gold Medal, donated yearly to the society by James F. Lincoln, to G. S. Bernard, Jr., left, and G. O. Hoglund, center*

War Would Prove Disastrous to Industry, R. E. Desvernine Tells Society for Metals

CHICAGO—"The proverbial munitions maker's wife will be a shabby creature in the next war," said R. E. Desvernine, president Crucible Steel Co. of America, in an address at the annual dinner of the American Society for Metals at the Palmer House on Oct. 26. "In my opinion," he said, "war would temporarily, if not permanently, sound the death knell of the free enterprise system."

Mr. Desvernine also stated that "you are not doing your duty to your profession if you continue to permit the impression to grow that scientific progress and the modernization of industry produce unemployment."

The same evening at the Stevens Hotel, the American Welding Society heard an address by O. W. Eshbach, dean of the Institute of Technology, Northwestern University.

These two talks were high spots of the National Metal Congress and Exposition Oct. 23–27, sponsored by the two above named societies together with the Wire Association and the Institute of Mining and Metallurgical Engineers. The week was crowded with a wide variety of events, including technical papers, business meetings, committee sessions and plant visits.

The Exposition, held simultaneously at the International Amphitheatre, was the chief point of interest. Thousands of visitors thronged past the 250 exhibition booths to view the latest advances in metal heat-treatment, welding, testing, and various kinds of metal-working equipment.

Ferrous Metals Improved

Metals, both ferrous and non-ferrous, reflected the more exacting demands that the increase in aircraft activity has put upon them. Republic displayed a group of aircraft and propeller engine parts. It also showed its copper-clad and "Corronized" steels. The former is a layer of silicon bronze rolled into a heavier steel sheet for use in such products as tanks, evaporators and water heaters. Corronized steels, a development of the Standard Steel Spring Co., are plated with a thin coating of corrosion-resistant material.

Bethlehem Steel Co. featured its new hardenability test, whereby steels are accurately graded for susceptibility to heat-treatment. Steps in the test are a preheat on special test bars, a heat above the critical, a water quench by jet into a cup-shaped end, surface preparation and a Rockwell hardness test at fine increments along the bar. Readings are plotted to give a hardenability curve.

Exhibit of the U. S. Steel Corp. was based on accuracy in control of the mill operations to produce high quality steels. American Steel & Wire Co., a subsidiary, showed some extremely fine gage wire mesh of stainless steel. Wire diameters were down to 0.0014 in., or one-third the size of a human hair.

C. A. McCune, left, A.W.S. convention committee chairman, looks things over at the Exposition. W. P. Woodside, right, retiring A.S.M. president, seems highly pleased with the show

Jones & Laughlin's booth was centered on its novel "Flame Control" process for making Bessemer Steels. By means of a photo-electric cell, the "end point" of the blow is determined scientifically instead of being left to the eye of the operator.

A new alloy has been introduced by Ryerson under the trade name H.T.M. It has a chrome-nickel-molybdenum composition, is deep hardening and has good impact resistant qualities at low temperatures. Rex-Alloy, the latest product of the Crucible Steel Co., is a non-ferrous cutting alloy.

Welding Developments Shown

Arc welding displays plainly reflected the more widespread use of this process. Units for the job shop and other small users took their place beside improved models for the larger manufacturing plants. Lincoln Electric Co. showed several such units including a low-priced 200-amp. portable generator and a complete small vertical unit of the same capacity. Among the larger equipment was a new diesel-driven welder with a gasoline engine starter made in sizes of 200, 300 and 400 amp. Lincoln also introduced an arc cleaning attachment for its standard welders, consisting of an exhaust fan mounted on the generator with a flexible vent for the welding booth.

Wilson had a new line of "Hornet" portable arc welders with emphasis on ease of control. A switch selects either high or low range while a single handwheel gives fine adjustment within each range. Remote control is also available which enables the operator to start and regulate the generator from his position at the arc. With this arrangement, automatic stopping is provided if the arc is left idle a minute and a half.

A low-cost arc welding generator for single-phase lines was introduced by Hobart Bros. Co. Glass insulation gives the unit compactness and moisture resistance. It operates on single-phase lines or on one leg of two- or three-phase lines.

Una Welding, Inc., showed a wire feed arc welding head which automatically applies the coating in the form of a tape. This machine strikes the arc, maintains it at the correct length and keeps a preset voltage by feeding the welding wire at the proper rate.

New gas welding and cutting Oxweld nozzles, designed by Linde Air Products, give better mixing and greater economy. For the small user, a portable gas generator is offered. Multiple cutting and flame hardening tips are now so commonly used that a heavy duty traveling head CM

21 is supplied. It is especially useful for heavy plate preparation.

A demonstration of flame-hardening bed ways was shown in the Air Reduction booth. This process, developed originally for the Monarch Machine Co., immerses the cast iron bed in a tank of water leaving the ways exposed for treatment by multiple tipped torches and water nozzles.

A durable deep black plated finish was shown actually applied in the duPont booth. The finish may be used lustrous or dull according to surface preparation. The plating process is fast and the finish durable. It is a molybdenum nickel process which is trade named "Moly-Black."

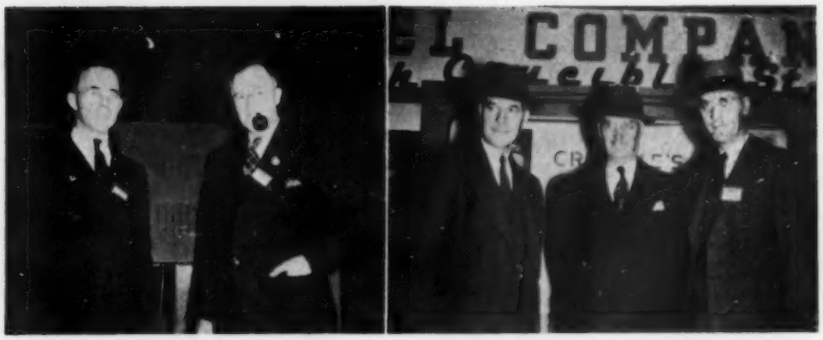
Among the mechanical equipment was the Moore jig grinder, distributed by Marburg Bros., Inc. This machine, a development from the Moore jig borer, grinds straight or tapered holes. It is useful in accurately finishing hardened dies.

F. S. Denneen, left, rests a bit. Right P. C. Osterman catches sight of an interesting exhibit

Tinius Olsen has introduced an inexpensive hydraulic testing machine rated at 60,000 lb. It can be used on tension, compression and transverse tests with capacity for the toughest steels using a 0.505 in. test bar. It is especially designed for foundry and school use.

Hardening Methods Demonstrated

An interesting example of "control" of flame hardening to secure approximately identical hardness at various separated points on a surface was demonstrated by National Cylinder Gas Co. The machine, developed for Ahlberg Bearing Co., hardens surfaces against which setscrews will later bear. A slotting operation to split the bushing had to be done after hardening, so it was necessary to harden a conical bearing surface for the setscrews without melting the thin edge. It was advantageous to make it a simple automatic operation. An automatic timer rotates the bushing at proper intervals so that one seat is being quenched while the next is being heated by the torch.



At the Exposition—*G. G. Landis, extreme left, pauses in a chat with A. F. Davis. Right, S. C. Spalding, R. E. Christie and W. R. Frazer, from left to right, take time out while making the rounds of the displays*

MILLIONS TO MECHANIZE ARMY

WASHINGTON—The War Department is preparing to award 12,000 motor vehicles of various types for delivery before next May 1. This is in line with the program to put the U. S. Army on wheels as quickly as possible. These awards, totaling $15,000,000, will be the largest peacetime procurement of motor vehicles in the Army's history. They will give the Army altogether over 26,000 vehicles.

The French government has placed an order for 2,000 trucks with the White Motor Co., and an order for 2,500 trucks with Studebaker Corp., and an order for 2,000 trucks with General Motors Trucks. Further purchases of motor vehicles by the Allies is looked for.

SOVIET BUYS $15,000,000 OF EQUIPMENT IN U. S.

NEW YORK—Soviet Russia's purchases in the United States rose to the formidable total of over $15,000,000 during September. Of that amount $7,837,107 consisted of machinery and machine tools, $552,722 of electrical equipment, $284,078 of tools and dies, $151,986 of steel plant equipment, and $176,101 of aeronautical equipment. Included in the total was $4,900,000 for a bi-metal mill bought from the Mesta Machine Co., Pittsburgh.

Amtorg has recently concluded an agreement with Briggs Mfg. Co., Detroit, to supply body dies at a cost of about $2,000,000 for the new four-cylinder midget car to be built in Russia. The bodies for this car will be manufactured at Gorky; the forgings, frames and springs at the Stalin plant in Moscow; and cars are to be assembled at the remodeled Kim factory in Moscow.

FIVE AIRPLANE MANUFACTURERS TO SHARE $13,000,000 ARMY ORDER

WASHINGTON—Army Air Corps has awarded airplane contracts totaling $13,368,410 to five companies. Curtiss-Wright secured an order for $5,203,481, Seversky Aircraft an order for $3,547,255, Bell Aircraft an order for $2,833,236, Fairchild Aircraft an order for $1,586,573, and Ryan Aeronautical an order for $197,865.

Other sizable government awards include $1,122,400 to Defoe Boat & Motor Works, Bay City, Mich., for submarine chaser hulls and fittings; $311,906 to Federal Telegraph Co., Newark, N. J., for radio equipment; $905,060 to Pelton Water Wheel Co., San Francisco, for turbines; $151,200 to DeLaval Steam Turbine Co., Trenton, N. J., for pumps; $105,900 to Enterprise Engine Co., San Francisco, for Diesel engines; and $425,153 to E. I. Du Pont de Nemours & Co., Inc., for smokeless powder.

ENGINEERS RIDICULE USE OF PLASTICS FOR AUTO BODIES

DETROIT—Despite all the talk about car bodies being made out of plastics some day, automotive authorities scout this possibility. They are in full accord with the trend toward the use of plastics for insulation and decorative purposes, but say emphatically that plastics should not be specified for parts requiring structural strength. Though Ford is known to have been experimenting with fenders made of plastics, other car makers don't think much of the idea.

There is no reason, however, why plastic car trunk lids should not be employed, because no real stress is put on them. Plastics will continue to find new uses in car interiors, but for bodies and many other parts steel appears in no danger of being supplanted.

Behind the Footlights—*Cast of "Review and Preview," A.G.M.A. production, included left to right (rear row) Howard Dingle, G. L. Markland, D. W. Diefendorf, E. S. Sawtelle, H. H. Kerr, A. A. Ross and U. Seth Eberhardt. In the front row are R. B. Zerfey and J. C. McQuiston*

S. Wells Utley Traces Industrial Progress At Semi-Annual Meeting of Gear Makers

ST. JOSEPH, Mich.—Industry's part in the development of civilization was traced by S. Wells Utley, president Detroit Steel Castings Co., at the dinner meeting of the American Gear Manufacturers Association. Occasion was the Association's second semi-annual meeting held at the Whitcomb Sulphur Springs Hotel, St. Joseph, Mich., Oct. 16–18. Going back to the history of ancient Egypt and following the course of commerce and manufacture through the centuries, Mr. Utley showed that "where commerce has gone, wealth, power and progress have followed."

The sessions were opened by a welcoming address by the association's President Charles F. Goedke, Ganschow Gear Co. This was followed by a paper, "Experiences in the Gear Industry," by U. Seth Eberhardt, Newark Gear Cutting Machine Co., vice-president of the A.G.M.A.

A high spot of the meeting was a two-act farce which enlisted the stagecraft of Secretary J. C. McQuiston, R. B. Zerfey, Tool Steel Gear & Pinion Co., and six A.G.M.A. past presidents (or their equivalent). Included in the cast were G. L. Markland, Philadelphia Gear Co. (for B. F. Waterman) U. Seth Eberhardt (for E. W. Miller) A. A. Ross, General Electric Co., E. S. Sawtelle, Tool Steel Gear & Pinion Co., H. H. Kerr, Boston Gear Works, and Howard Dingle, Cleveland Worm & Gear Co.

At the more serious sessions, the members heard an outstanding assortment of technical papers. "Modern Trends in Nickel Steel and Cast Iron Gear Materials" was presented by C. M. Schwitter, International Nickel Corp. Mr. Schwitter showed that both the mechanical and fabricating properties of a material must be considered in selecting it for gear applications.

J. M. S. Hutchinson, Chrysler Corporation, spoke on the Superfinishing process developed by his concern. He described the methods of putting this process into practice and some of its advantages.

"Gear Grinding" was the subject of a paper by John Dixon, Pratt & Whitney Co. This speaker described the machines available for this operation together with some set-up fixtures that have been used to advantage.

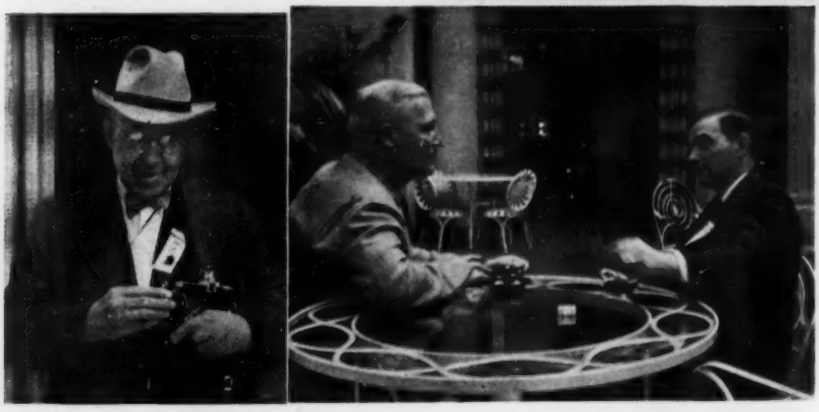
In an address on gear noise, F. A. Firestone, University of Michigan, demonstrated how it is possible to solve problems in mechanical vibration by the use of mathematics ordinarily employed for analogous electrical circuits.

Cost finding in the gear business was analyzed by Paul Christensen, Cincinnati Gear Co., who applied an original approach to the problem.

Technical committees were especially active, and three reports in particular deserve mention. H. A. McConville, General Electric Co., reported for the Gear Lubrication Committee, tracing the large amount of progress made by this group.

As chairman of the Helical & Herringbone Gear Committee, W. P. Schmitter, chief engineer Falk Corp., gave recommendations as to the proportions of cast steel gears. Acting Chairman Granger Davenport, Gould & Eberhardt Co., reporting for the Committee for Inspection and Tolerances, offered for consideration a tentative set of limits for basic variations in gear dimensions.

C. F. Goedke, U. Seth Eberhardt and H. A. McConville, Gear Lubrication Committee chairman, talk things over at left. Right, guest speaker S. Wells Utley chuckles at a good one pulled by J. C. McQuiston, A.G.M.A. secretary, right



A. H. Candee, an ardent camera fan, left, was chairman of the Gear Geometry Committee. Right, John H. Flagg, chairman of the Gear Motor Subcommittee, discusses "the situation" with A.G.M.A. treasurer R. S. Marthens

INSIDE DETROIT

By Rupert Le Grand
DETROIT EDITOR

Chrysler employees are likely to return to work pending further contract negotiations, but with little hope of winning major concessions. Result: huge losses for both sides.

DETROIT — October production of cars and trucks can hardly exceed 325,000 units unless the Chrysler Corp. can re-open its plants before the month-end under a compromise agreement said to have been worked out by Federal labor conciliator Dewey. As it was, the corporation had lost 45,000 units by the time that the State Labor Mediation Board pulled out in a huff, leaving the field free for the skilled Mr. Dewey.

The announcement that Dewey saw an imminent settlement came from A. C. Lappin, departing State board member, who has been at loggerheads with the federal man. Even if Lappin's statement was premature, it is believed that considerable progress would be made with Dewey bringing together the principals in the controversy. All the federal government cares about is getting the men back to work, and considerable pressure could be brought to bear on union chiefs to show them the error of their ways.

Even with a back-to-work movement authorized pending further negotiations on a new contract, it is inconceivable that the Chrysler management will make important concessions regarding two of the chief issues in the strike — granting the union shop and sharing responsibility in setting rates of production.

Minor Concessions Possible

It is possible that the corporation might meet a secondary demand for a ten-cent-an-hour raise, either in whole or part, and that changes might be made in the grievance procedure and seniority provisions. But the men are more likely to go back to work under the company's terms than the union's, with the result that the latter will be on the defensive in further negotiations. The net result may be a good black eye for certain union heads, and a dampened enthusiasm for making more trouble concerning alleged "speed-ups." For example, the action of the Chevrolet workers in Flint in threatening to strike if an alleged speed-up were not ended, and the union permitted to share in establishing production rates, is likely to be forgotten as too hazardous.

A shut-down of an industrial concern the size of Chrysler has serious consequences, and the repercussions may have salutory effects on the union chiefs and rank and file in the future. For example, consider the major losses incurred should the corporation's plants be closed from Oct. 9 to, say, Nov. 1. During only seventeen working days, the company would lose 80,000 vehicles, worth at least $52,000,000 wholesale. Wages lost by 50,000 Chrysler workers would come to $6,000,000. To these must be added wages lost by employees at Briggs and hundreds of other suppliers. And huge sums will not be spent for materials and parts because production lost by such a strike cannot be made up later. In addition, 11,000 Chrysler dealers have little to sell under a prolonged shut-down and the business goes elsewhere.

It is possible that the union's demand for mutually agreeable standards of production was only a smokescreen for securing a union shop. And it is conceivable that the union shop clause was only an excuse to tie up the company's production. That clause has been worked before, and union chiefs have beaten a strategic retreat in cases where they could not secure that plum. With no advantage secured in either direction as a result of the Chrysler slowdowns, the charge is sure to be heard that the plants were closed through a communistic urge to sabatoge one of the best fall production seasons seen in years.

Financial Strain Terrific

But suppose that the union heads want to prolong the quarrel into a real test of strength with the Chrysler management. Will unemployed members be able to stand the financial strain?

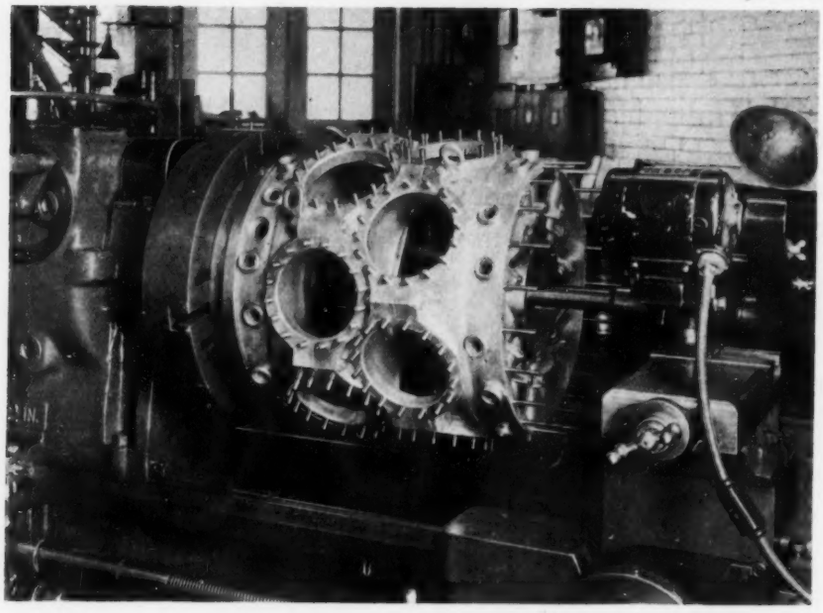
It is inconceivable that the union has the funds to alleviate distress among its members, and consequently attention is focused on what might be done by the Michigan Unemployment Compensation Board. Inquiry at the Commission's offices disclosed

FEWER CHANGES FOR '41

DETROIT — Car manufacturers are planning on making few changes in design for 1941. They feel that the industry is in the midst of a consumer buying movement which will last through the 1941 model year without interruption. It is traditional in the industry that radical changes are not attempted when sales are on the upswing. A minimum of retooling will be done for '41.

Wide World

Slowdown—*Members of the UAW-CIO picket the Dodge plant in Detroit following disruption of production called a slowdown by Chrysler Corporation officials and termed a lockout by union spokesmen. "We are using the tactics of a strike but we call it a lockout," union leader Richard T. Frankensteen is quoted by the New York* Times *as saying. The union wants a closed shop and a voice in setting production rates. Efforts of the State Mediation Board to settle the controversy proved fruitless, so federal labor conciliator Dewey took over*



Prizewinner—*United Air Lines won* Aviation *magazine's Annual Maintenance Award this year with the modern methods of overhaul and repair used at its Cheyenne base. Special fixture above permits installation of main crankcase liners so that accuracy of alignment of three bearings is held to 0.0005 in.*

that 30,000 persons had applied for compensation as a direct result of the strike. No decision had been taken last week by the Commission concerning who would and who would not be eligible. Intensive field work was underway to determine the facts in the case, and workers' causes for unemployment were being carefully studied. Neither Chrysler nor the union had submitted their sides of the case in full, and until they did so it would be impossible to begin a final determination of policy.

The Benefit Problem

The Commission's decision concerning which workers would get benefits and which would not in the Chrysler situation could not be rendered until after Nov. 1. Evidence must be obtained from actual production records from Chrysler plants, even down to departments. It may be found, for example, that workers in one department are culpable in starting a work stoppage, and that those in some other department in the same plant are not. Thus, statements and records from both sides must be studied in voluminous detail. Unemployed workers at Briggs and other suppliers will be eligible for payments as disinterested workers.

What does this mean to the unemployed Chrysler worker? First, he cannot expect an unemployment compensation check before the fifth week of the strike—if it lasts that long. In other words, he will get nothing until the week of Nov. 5 and more likely the week of Nov. 12. In the latter case, he will have had little or no income for five weeks. And he can figure his net loss like this: Five weeks at an average of $38.00 equals $190.00 in wages lost. Offsetting this would be compensation for four weeks at $15.00 per week, or a total of $60.00 (a one-week waiting period will be required in most cases). Thus the worker's net loss if unemployed for five weeks amounts to $130.00, or close to 10 per cent of his annual wage. And since he would not receive any income until the sixth week of the strike, it is conceivable that his desire to continue the battle will be on the wane.

Under these conditions it does not seem probable that the union can wring important concessions from Chrysler in a long strike. In contrast to two years ago, there is no government agency that is avowedly anxious to underwrite the strike for the union. Even should the Michigan Unemployment Compensation Commission disqualify few Chrysler workers, the late arrival of its benefit checks might stop the union in its tracks. Most of the 30,000 new applicants were without work during the model changeover and can't have much in the way of resources for a protracted struggle.

BUSINESS ITEMS

The Candler-Hill Corp., 2200 Eighth St., Detroit, was formed Oct. 1 to manufacture fuel pumps of its own design for military and transport aircraft engines and for stationary and automotive diesel engines. Precision ground parts will also be made for the trade.

Organizers of Candler-Hill are BOYER CANDLER, formerly assistant treasurer Burroughs Adding Machine Co., and EDWARD J. HILL, formerly vice-president Chandler-Evans Corp. New and used equipment has been bought for the enterprise, which is occupying floorspace of 75x100 ft., and will employ approximately fifteen men.

Ohio Gear Co., Cleveland, Ohio, has appointed Standard Machinists Supply Co., Pittsburgh, Pa., as representatives for its line of power transmission equipment.

Hein-Werner Motor Parts Corp., Waukesha, Wis., is planning to erect a one-story 50x75-ft. addition to its plant at an estimated cost of $15,000.

International Harvester Co. has transferred manufacture of several implement lines at Rock Falls, Ill., to the McCormick works in Chicago and the parts department to the works in East Moline, Ill. Coil spring production which has been carried on at the Springfield, Ohio, plant will be shifted to Rock Falls.

General Electric Co., Schenectady, N. Y., has completed transfer of its specialty appliance division from Cleveland, Ohio, to Bridgeport, Conn. Bridgeport will henceforth be headquarters for administrative, commercial, financial and advertising divisions of the appliance and merchandising department. A new appliance and merchandise institute is being constructed near the main entrance of the company's Bridgeport plant, which is expected to be completed by Dec. 1.

New Wrinkle, Inc., Dayton, Ohio, has licensed the St. Louis Surfacer & Paint Co., St. Louis, Mo., and Allied Finishing Specialties Co., Chicago, Ill., to manufacture its line of wrinkle finish varnishes.

Skilsaw, Inc., Chicago, Ill., manufacturer of electric saws and other portable electric tools, plans a $35,000 addition to its recently completed plant.

George D. Miller Co., Cleveland, Ohio, has been named distributor for the "All-Angle" milling attachments made by the Fray Machine & Tool Co., Glendale, Calif.

A. C. PRESTON, Wilbraham, Mass., has begun manufacture of a line of augurs and boring tools in the plant at Tracy, Conn., formerly occupied by Jennings & Griffin.

T. B. Wood's Sons Co., Philadelphia, Pa., has appointed the following distributors for its line of power transmission machinery: Louisville Mill Supply Co., Louisville, Ky.; M. D. Larkin Co., Dayton, Ohio; Henry D. Clark, Newark, N. J.

PERSONALS

KENNETH H. CONDIT, consulting editor of *American Machinist*, has been appointed Dean of the School of Engineering of Princeton University to succeed Professor Arthur M. Greene, Jr., who will retire next June. Mr. Condit was editor of *American Machinist* from 1921 to 1938, and more recently has been executive assistant to the president of the National Industrial Conference Board. He is a mechanical engineering graduate of Stevens Institute of Technology (1908), and five years later received the degree of Civil Engineering from Princeton University. For many years he has been prominent in the American Society of Mechanical Engineers of which he is now vice-president.

KENNETH H. CONDIT

CHESTER W. RUTH has been appointed Director of Advertising for Republic Steel Corporation. He succeeds Stanley A. Knisely who resigned recently to become Executive Vice-President of Associated Business Papers, Inc. Harold H. Oldham will take over Mr. Ruth's former duties as Assistant Director of Advertising. Mr. Ruth has been connected with Republic since its founding in 1930.

BENJAMIN H. GILPIN has been named executive vice-president and a director of Chandler-Evans Corp., Meriden, Conn., manufacturer of aircraft carburetors. Mr. Gilpin was formerly general manager for the Bendix Aviation Corp. and factory manager for Pratt & Whitney Div. of the United Aircraft Corp.

JOHN G. LEE has been appointed assistant director of research in charge of the technical branch, United Aircraft Corp., East Hartford, Conn.

JAMES S. KNOWLSON

GEORGE CHAPMAN

CARL M. SNYDER

JAMES S. KNOWLSON, chairman of the board Stewart-Warner Corp., Chicago, Ill., has been elected president. FRANK ROSS, a vice-president, was elected a director to fill the vacancy caused by the resignation of JOSEPH E. OTIS, JR., former president and director.

P. M. BRATTEN has been appointed head of all activities of the household sales division, Frigidaire Div. of General Motors Sales Corp., Dayton, Ohio.

IRA J. OWEN has been elected president of Kalva Venders, Inc., Chicago, Ill., manufacturer of beverage dispensing machines.

L. M. KIRK has been made superintendent of the No. 2 open hearth furnace of the Gary Works of the Carnegie-Illinois Steel Corp. GEORGE MCMORRAN has been named assistant superintendent of No. 2 open hearth, and I. G. BROWN appointed assistant superintendent of No. 4 open hearth.

JOSEPH G. JACKSON, for more than 40 years associated with the Edward Katzinger Co., Chicago, Ill., manufacturer of bakers' and confectioners' tinware, tools and supplies, has been appointed vice-president in charge of manufacturing. BENSON LITTMAN, for the past 20 years sales representative and general manager of the Baltimore plant, has been named vice-president in charge of operations and general manager of the Baltimore plant. THOMAS A. DILLON has been appointed vice-president in charge of bakery sales, and PAUL CRISSEY vice-president in charge of hardware sales.

G. H. ROBERTSON has been named head of the industrial sales department of the Sherwin-Williams Co., Cleveland, Ohio. Additional appointments in the industrial sales department include E. L. HEHL, eastern manager; H. S. SHERMAN, central district manager; and LYMAN WEBER, southwestern district manager.

GEORGE CHAPMAN and CARL M. SNYDER have been named assistant managers of the appliance and merchandise department of General Electric Co., Bridgeport, Conn.

Mr. Chapman, who has had 26 years of experience with General Electric appliance activities, will assist H. L. ANDREWS, vice-president and executive head of the company's appliance and merchandise department, in his new capacity in the administration of the appliance division. Mr. Synder will be responsible for the sales and sales activities of the articles made by the appliance and merchandise department, as well as for sales of radio and television receivers and tubes.

H. S. MEECH has been appointed sales manager of Buckeye Brass & Mfg. Co. Cleveland, Ohio. Mr. Meech was formerly connected with the Behr-Manning Co.

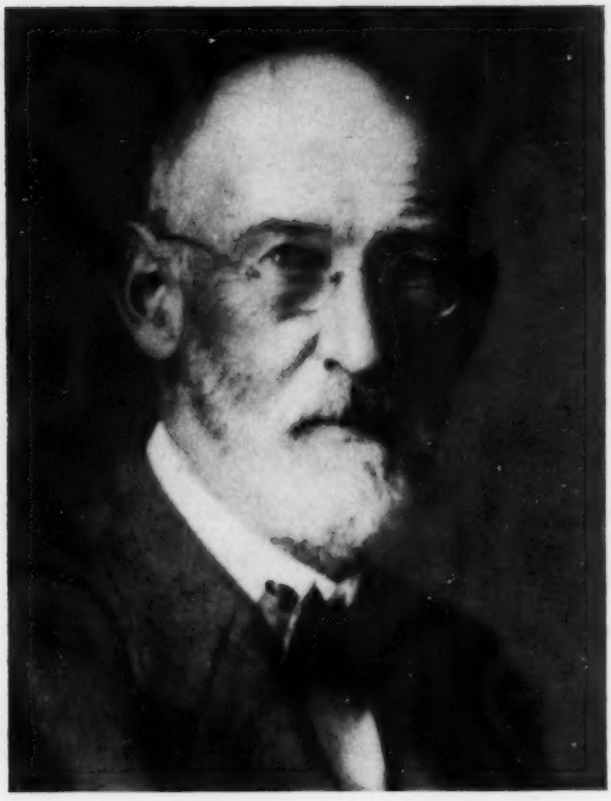
E. G. PARSONS has been appointed New England and metropolitan New York district sales manager of the Wm. Schollhorn Co., New Haven, Conn.

C. W. HEDLER, formerly manager of distributors' sales, and R. L. MILLER have been appointed assistant sales managers of the Norma-Hoffmann Bearings Corp., Stamford, Conn.

WILLARD A. TERRY, for several years associated with the welding section of the industrial department of the General Electric Co., Schenectady, N. Y., has been placed in charge of electric welding sales along the Atlantic seaboard. His duties in Schenectady will be assumed by C. I. MACGUFFIE, arc welding specialist in the Atlantic district.

THOMAS D. LANE, formerly production engineer with the American Gas Machine Co., Albert Lea, Minn., has been appointed chief engineer of the Lonergan Mfg. Co., Albion, Mich.

WILL VIALL PASSES AWAY



WILL VIALL

PROVIDENCE—William A. Viall, long recognized as the dean of the machine tool industry, died at his home here Oct. 24. He would have been 78 years old two days later. For many years he had been vice-president and secretary of the Brown & Sharpe Mfg. Co. and active in several other prominent metal-working companies.

Mr. Viall first became associated with Brown & Sharpe in 1890, and in 1906 was elected secretary of the organization. Several years later he was made vice-president and secretary, and subsequently was elected president of the Brown & Sharpe Co. and of Brown & Sharpe of New York, Inc., two subsidiaries. Other of his business affiliations included the Gorham Co. and the Gorham Mfg. Co., which he served as director, and the Wilcox & Gibbs Sewing Machine Co., of which he was president. He had also been a former president of the Manufacturers Research Association of Boston, the New England Foundrymen's Association, and the National Machine Tool Builders Association.

Those who knew Will Viall personally will feel a deep loss at his passing. In his various capacities he met his many problems in a calm and kindly fashion. Well mannered, yet positive in his connections, he treated everyone with consideration and will long be remembered affectionately by all who knew him.

C. G. Barth, consultant on scientific management problems for many years, died at his home in Philadelphia Oct. 8 at the age of 73. Born in Oslo, Norway, he early became associated with Frederick W. Taylor as mechanical engineer with the Bethlehem Steel Co. From 1901 until his retirement in 1923 he engaged in development and introduction of the Taylor System.

William C. Acklin, 51, president Acklin Stamping Co., Toledo, Ohio, died Oct. 9. He was the last of three brothers who, with their father, the late Grafton Acklin, founded the firm in 1911.

Clement C. Richard, president Allied Products Corp., Detroit, Mich., died Oct. 9 at the age of 53. With his brothers Clarence A. and Otis K. Richard, he founded the Richard Brothers Die Works in 1915, which became the principal unit in Allied Products when it was organized in 1928. Mr. Richard was an outstanding figure in the die industry and his contributions as an inventor were numerous.

George A. Steinle, 74, prominent Madison, Wis., manufacturer and inventor, died in that city Oct. 10. Mr. Steinle was founder and president of Steinle Machine Co., and had also headed the Four Lakes Ordnance Co., which during the World War manufactured naval guns.

Kenneth B. MacLeod, vice-president Abrasive Machine Tool Co., Providence, R. I., died Oct. 23. He was 46 years of age.

W. A. BROWN

W. A. Brown, president Liquid Carbonic Corp., Chicago, Ill., manufacturer of food processing machinery, died Oct. 16 at his home in Oak Park, Ill., following an illness of several weeks. He was 61 years of age.

Mr. Brown took up his duties with Liquid Carbonic in 1901 at Kansas City, Mo. During the following years he served in various capacities with the company, becoming its president ten years ago. He was also chairman of the Service Caster & Truck Co., Albion, Mich., a director of the Interstate Co., and one of the founders and first president of the National Association of Manufacturers and Distributors.

MEETINGS

American Society of Mechanical Engineers. Sixtieth annual meeting, Bellevue-Stratford Hotel, Philadelphia, Pa., Dec. 4-8.

Industrial Management Society. National time and motion study clinic, Medinah Club, Chicago, Ill., Nov. 3 and 4.

Motor and Equipment Manufacturers Association. Annual meeting, Blackstone Hotel, Chicago, Ill., Dec. 12.

Society of Automotive Engineers. National fuels and lubricants meeting, Mayo Hotel, Tulsa Okla., Nov. 2 and 3.

Cutting, Measuring and Hardening Machines Announced at Springfield Show by Fellows

A new straight-line gear generator, a fine-pitch gear shaper, a horizontal gear shaper, a larger involute measuring machine and a flame hardening machine for local hardening gear teeth and other parts were introduced at a locally sponsored machine and tool show in Springfield, Vt., recently by The Fellows Gear Shaper Company of Springfield. Designed especially for cutting small external spur and helical gears on a high-production basis, the straight-line gear generator shown in Fig. 1 differs from the fine-pitch gear shaper in that it uses a rack-type cutter, see Fig. 2, that is carried in a clapper-box type holder. This holder is mounted on a swivel plate attached to a slide which is reciprocated at speeds as high as 2,000 strokes per minute. The rack cutter is made 6⅜ in. long, or approximately the same length as the pitch circumference of a 2-in. gear, which is the maximum capacity. For cutting smaller gears, the rack cutter is made with groups of teeth separated by gaps. The number of teeth in each group equals the number of teeth on the work to be cut. When this machine is equipped with a magazine feed, and is operating automatically, the position of the rack cutter relative to the work is controlled by dogs which operate a reversing mechanism that changes the direction of the travel of the bed. These dogs can be set for short travels at any point within the maximum travel of the bed. The dogs usually are set to use the first group of teeth at one end of the cutter until they become dull, then the dogs are shifted to bring the next group of teeth into position. The bed of the machine carrying the rack holder and slide is traversed by a leadscrew and a gear is finished with each stroke in either direction. A compensating device built into this machine works in combination with the work change gears and affects the linear travel of the bed to keep the rack cutter in proper relation with the work. It also affords a means for effecting slight increments in the rate of travel of the rack cutter without altering the change gears. This straight-line gear generator also can be arranged for hand loading, in which case a limit switch stops the machine at the completion of a gear.

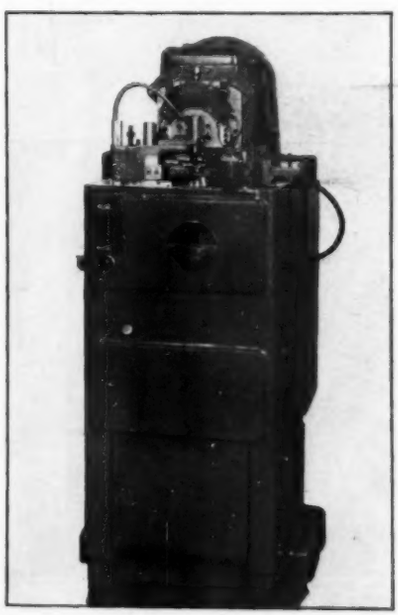


Fig. 1—The Fellows straight-line gear generator uses a rack-type cutter for small external fine-pitch gears

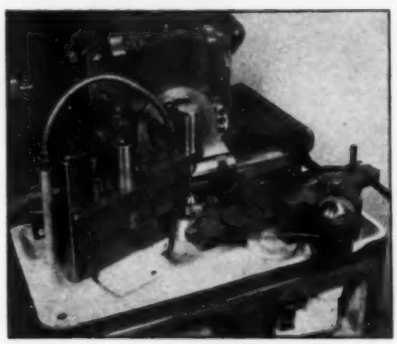


Fig. 2—Rack-type cutter, automatic magazine, and the work holding and ejecting mechanisms of the straight-line gear generator are shown in this close-up view

The fine-pitch gear shaper shown in Fig. 3 has capacity for cutting small fine-pitch gears up to 3-in. pitch diameter with ¾-in. face width. It is said to be particularly adapted to precision, high-production requirements. This machine incorporates effective means for automatically feeding, holding, clamping, driving and ejecting the work. Another innovation is the use of cutter reciprocating speeds up to 2,000 strokes per minute. The magazine is of "box" section and is made to suit the shape and character of the work. It is held on a three-cornered operating shaft. When handling thin blanks, the blanks are stacked on an auxiliary holder and the assembly is fed through the magazine. The lower face of these holders is serrated and these serrations mesh with corresponding serrated sections in the locating and driving adapter on the work spindle. The work-clamping mechanism operates in conjunction with the feed magazine, and carries a ball-bearing centering

Fig. 3—A disk-type cutter is employed in this Fellows fine-pitch gear shaper for external and internal gears. It will cut 3-in. diameter gears

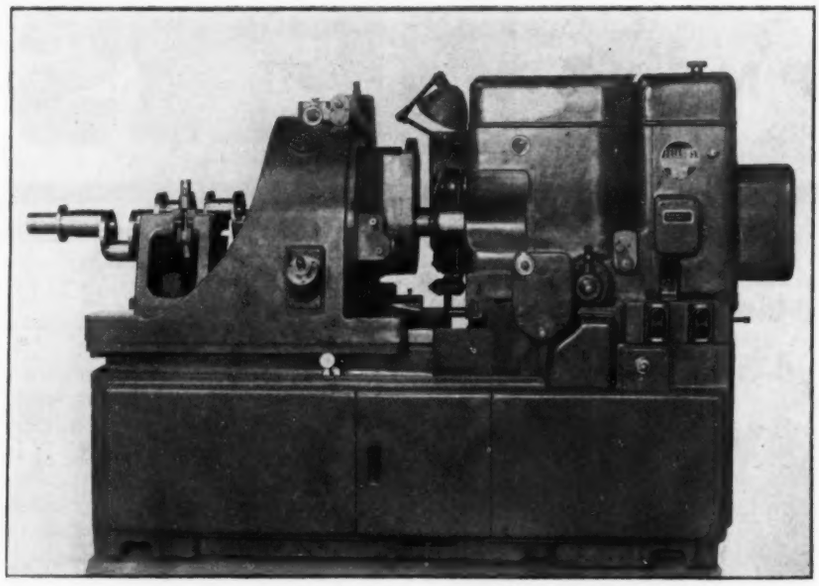


Fig. 4—Gears integral with long shafts can be cut quickly in this Fellows horizontal Model Z gear shaper. Work and cutter slides are adjustable at right angles to each other. Cutter spindle is of the "relieving" type

and clamping support. The work support carrying the clamping member is elevated by a cam which is timed with the cam operating the magazine. This support is acted upon by spring tension which is sufficient to hold the work in place when the teeth are being cut. When the work support is raised by one cam, a second cam, which is timed with the work-support cam, at the same time raises a work ejector to remove the work from the adapter or work-spindle.

As the work is elevated, another ejector working in conjunction with the work support is released to eject the work from the cutting position. The magazine then swings into position for loading another gear or blank assembly, the support lowers to clamp the work, the magazine withdraws, and the cutter is fed in to depth. The cutter spindle continues its reciprocating motion when loading and unloading operations are being effected. A micro-switch operating a red light at the front of the machine indicates when the magazine requires reloading. This machine also is available, without magazine, for hand loading. Maximum capacity of the magazine is 2-in. diameter.

The Model Z horizontal gear shaper is an interesting departure from the regular line of gear shapers offered by Fellows. It is particularly suited to the machining of gears or clutches that are integral with long shafts, airplane engine crankshaft shown in position in the machine in Fig. 4. In this machine, the work spindle is mounted in a slide which is

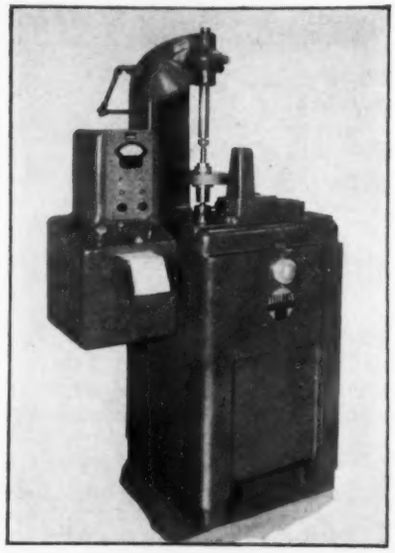


Fig. 5—An electrical recording device is shown mounted on the No. 12M involute measuring machine

adjustable along the base for positioning the work relative to the cutter. This slide also carries a bracket which retains a swinging shoe that provides additional support for the work. The work is held in an adapter retained in the work spindle, the latter having an 18-in. diameter straight hole.

The cutter spindle, which is of the "relieving" type, is held in the head slide, the latter being adjustable along the base in a direction at right angles to the work slide. Movement of this slide controls the diameter setting of the cutter with relation to the work. The cutter spindle is controlled by a guide in a manner similar to the regular vertical gear shapers. The machine is provided with an electric pushbutton control and a mechanism which stops the machine when the work is completed. Maximum capacities are: movement of work slide, 19 in.; movement of cutter slide for external gears, 6½ in.; for internal gears, 2 in. Maximum pitch radii of work are determined as follows: for external gears, subtract the pitch radius of the cutter from the 6½-in. center distance; for internals, add the pitch radius of the cutter to the 2-in. cutter slide movement.

Similar in design to the previously announced No. 6M involute measuring machine (*AM*—Vol. 83, page 350), the No. 12M involute measuring machine is larger and heavier in construction to accommodate the increased capacity. The work spindle of this larger machine is mounted in preloaded bearings of special design to retain accurate alignment and ensure rigidity. It is rotated for "rolling" the involute by a friction wheel to prevent imposing any unnecessary strain on the mechanism. The work spindle sleeve is adjustable vertically to position the gear in correct relation with the involute pointer. It is possible to check the individual gears on a cluster, for instance, without removing the gear from the machine. A dead center is held in the work-spindle sleeve and a live center is mounted in the tailstock. The tailstock is adjustable through a rack and pinion and a counterweighted lever. This lever exerts sufficient friction so that no driving dog is necessary. The pointer slide is set in the radial position by a size block which, as shown

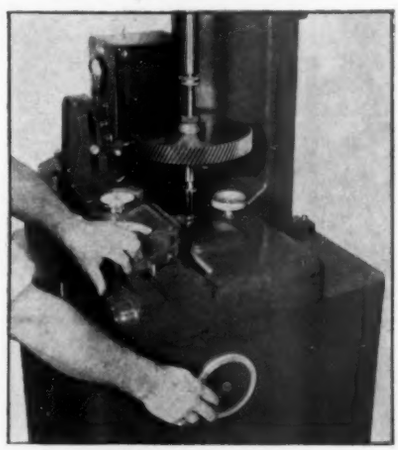


Fig. 6—Pointer slide of the No. 12M involute measuring machine is set in a radial position by a size block pivoted to the slide

in Fig. 6, is pivoted to the slide. A spring keeps this block in the raised position where it clears the fixed locating stop on the main slide when rolling the involute. The machine can, if desired, be equipped with an electrical recording device for automatically charting the involute profile. The machine also has an electric gage which can be used as a limit gage where a large number of gears are to be checked and where permanent records are not desired. Maximum capacity is 12-in. pitch diameter.

The Fellows flame hardening machine shown in Fig. 7 presents a method for local hardening gear teeth and other parts made from oil hardening stock. This machine has been designed to cover a wide range of pitches and sizes of gears, and to handle such work with very universal equipment. Set-up can be changed in a minimum of time for a wide variety of work. In operation, the gear is rotated and the entire circumference on which the teeth are cut is brought to proper temperature in a short time.

The work to be hardened is held on a stub arbor, or between centers, depending upon the shape and character of the work. Work is driven from the headstock spindle, the latter being rotated through an adjustable V-belt drive from the motor, and has a speed range from about 125 to 800 r.p.m. Foot treadles located at both ends of the machine operate an ejector for removing the work from the stub arbor, and a transfer device immerses the work in the quenching medium.

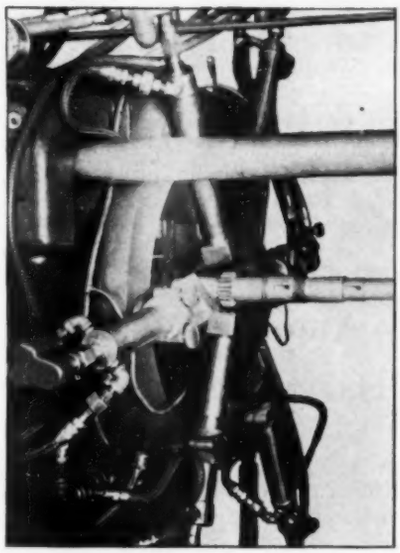


Fig. 8—Shafts having integral gears are held between centers for the flame hardening operation in the Fellows machine

As shown in Fig. 8, the work when in position in the machine is surrounded by six torches, each of which has a number of nozzles. The torches are carried on a saddle that is mounted on and is moved along two brass pipe supports, permitting the torches to be located at the desired position in relation to the work. The saddle carries all of the torches, pipes and valves for controlling the flame equipment. Number of torches and nozzles used depends upon the diameter, face width and pitch of the work. Any number of torches can be made inoperative through the operation of the necessary valves. When setup for a piece of work, a single valve is used for the gases supplied to the operating torches. This valve can be opened by hand from either end of the machine, and an electrical timing device can be provided for automatically closing the valve once the correct heating time has been determined. The saddle, saddle supports, torch carrier and plate at the rear of the work are cooled by circulating water. The elimination of obstructions beneath the work affords ample room for the insertion of a quenching tank. Maximum capacities are: diameter, 12 in.; face width, 2 in.; shaft length, 36 in.

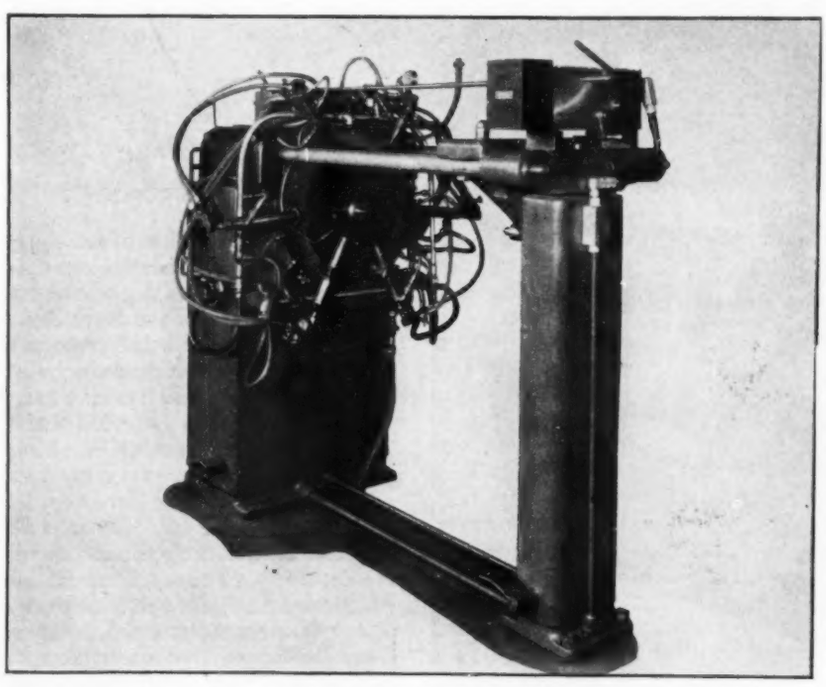
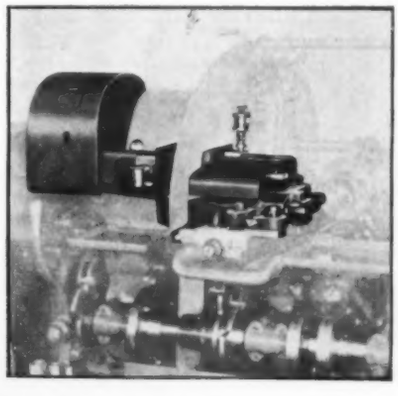


Fig. 7—Local hardening of gear teeth and other parts made from oil hardening steels can be accomplished economically in this Fellows flame hardening unit. A transfer device immerses the work in a quench tank set below the head when the proper temperature has been reached



Thread Chasing Unit Permits Accurate Work

Designed to suit a wide variety of work, the thread chasing attachment offered by the Brown & Sharpe Mfg. Co., Providence, R. I., for use on Nos. OO, OOG, O, OG, 2 and 2G high-speed automatic screw machines permits rapid production of threads of accurate form, lead and pitch diameter, such as those often required on parts for timing mechanism, electric meters and similar devices. Attachment is also of advantage in producing threads at the back of a shoulder on parts which cannot be satisfactorily threaded by other means.

Shaft of the attachment is gear-driven from the machine spindle to assure perfect synchronization. Chasing tool is carried on a double slide

assembly mounted on the front cross slide of the machine. Thread is produced by several passes of the tool along the work, cutting in one direction only. For any given set-up, the tool has a fixed path of movement relative to the cross slide, governed by a cam driven from the attachment shaft by a worm and wheel.

Change gears are furnished for cutting threads ranging from 13 to 40 threads per inch or from 0.5 to 2.5 mm. lead. Attachment may be arranged to cut either right-hand or left-hand threads at any set-up, and the machine spindle may be run either forward or backward as required.

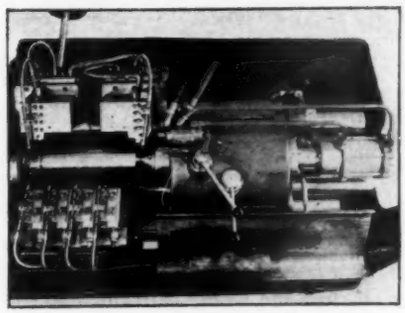


Fig. 2—Turning and facing operations on this steel forging are performed in about 80 sec. machining time with carbide-tipped tools

J. & L. 16 x 33-in. Fay Automatic Lathe Tooled for Turning Heavy Cylinders

Special tooling and work handling attachments mounted on this 16x33-in. Fay automatic lathe made by Jones & Lamson Machine Co., Springfield, Vt., permit rapid machining of heavy 5-in. diameter cylinders. Forgings are delivered to the machine already centered and are placed, one at a time, in the loading tray mounted on the tailstock assembly as shown in Fig. 2. The machine, shown in Fig. 1, is arranged to transmit the additional power required by hard alloy metal cutting tools, and is designed to withstand the heavy pressures imposed when using these tools.

It is a heavier and more rigid machine than previously has been available with the same capacity. The hydraulic unit, shown mounted at the end of the machine in Fig. 1, is a high-pressure unit of sufficient capacity to operate all of the hydraulic elements of the machine quickly. Although this machine is arranged for additional chip capacity it may be necessary, when turning with cemented carbide tipped tools, to provide a chip pit behind the machine. A large chip box may be placed in the pit for easy chip removal. The machine and tools are arranged so that the chips roll toward the rear of the machine.

When the forging has been placed in the loading tray, the operator performs the following sequence of operations in order to unload and load the machine: (1) open the hydraulic spindle fixture valve to release the machined piece; (2) unbind the tailstock ram and with the same lever open the hydraulic valve to withdraw this ram; (3) unlock the swinging tailstock with a lever mounted over the loading tray; (4) open the hydraulic valve to rock the tailstock clear, as the tailstock rocks up the loading tray automatically is carried into position for loading—no lifting is required on the part of the operator to slide a piece on or off the spindle fixture; (5) slide the turned piece off the spindle fixture onto the tray and move the rough piece into position on the fixture; and (6) close and lock the tailstock and driving fixture in reverse order to the opening procedure, and then start the machine. The operator then removes the turned piece and replaces it with a forging. Average loading time is 20 sec. for the piece shown, and average cutting time is 80 sec. for turning the outside diameter with four carbide-tipped tools while the back arms face and form the ends.

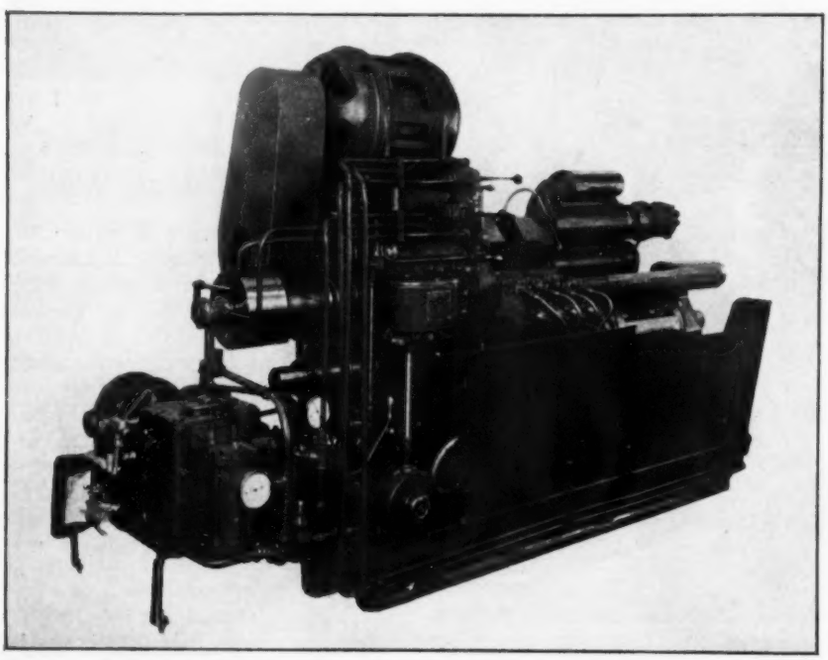
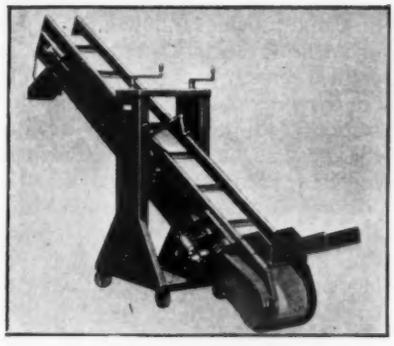


Fig. 1—This 16x33-in. Fay automatic lathe features an hydraulically operated tailstock fitted with a loading tray. The tailstock is rocked to one side to bring the tray into position

Handling, Storage Costs Cut by 'Eleveyors"

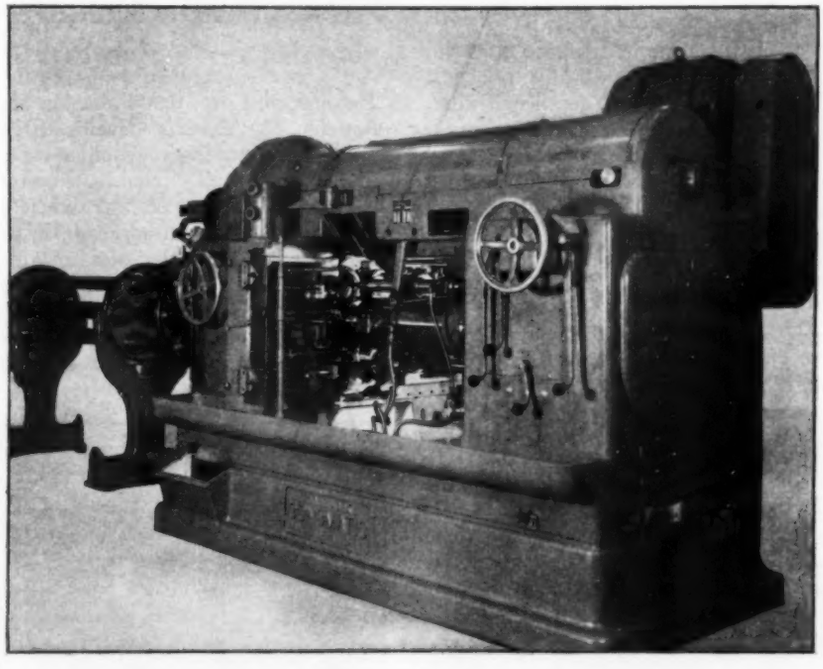
A solution to the problem of handling many small parts through successive operations to eliminate duplication of manual handling and excessive storage space is provided by "Eleveyors," a portable belt-type work loader built by Mechanical Handling Systems, Inc., 4600 Nancy Ave., Detroit, Mich. These units consist essentially of an endless belt conveyor assembly approximately 9 ft. long, driven by a ¼-hp. single-phase a.c. motor and mounted on a caster-equipped stand for mobility. The usual speed at which the 12-in. wide belt is driven is 60 ft. per min. Motor drives the conveyor headshaft through reduction gearing and steel roller chain and sprockets, the latter being inclosed by guards.

Height of the conveyor assembly and the angle of incline are adjustable



through a distance of 3 ft. and an angle of 82 deg. Conveyor headshaft is driven through reduction gearing and completely inclosed roller chains. An adjustable loading chute feeds the parts onto the 12-in. belt, where they are picked up by cleats. An adjustable delivery chute discharges parts at proper working heights or into a portable bin as shown. The usual oil-resistant belt can be replaced with one of wire mesh for handling hot forgings.

Six-Spindle 3½-in. "Conomatic" Operates Attachments Hydraulically



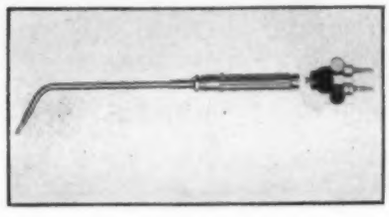
Stock feed and special attachments mounted on the improved 3½-in. capacity six-spindle "Conomatic" offered by Cone Automatic Machine Co., Windsor, Vt., are operated by an electrically-controlled hydraulic circuit. This heavy-duty machine retains the overhead camshaft, the heavy two-piece base structure for supporting the main vertical members, and full accessibility of all cams, tools and attachments, previously incorporated in the design of the smaller six-spindle and the four-spindle machines of the same type. A number of improvements in performance and operation have been claimed for the entire line of six-spindle Conomatics. Included among these are: (1) open end gearing; (2) the ability to place any attachments in operation within a minimum of time; (3) high and low speed cam action may be disconnected by the operator when checking tools; (4) power feed engagement is instantaneous, it operates by a touch of the lever and may be disengaged from either side of the machine; (5) power feed countershaft provides a wide range of feeds and a slow speed for tooling that can be moved quickly to high or production feed; and (6) the power feed reverse decreases tool-up time.

The six work spindles are mounted in adjustable anti-friction bearings and are driven through helical gears mounted close to the collets. The carrier is indexed by a modified Geneva motion designed for positive operation. It is locked in position during the working portion of the cycle. Each cross slide carries independent positive stops which insure work duplication. They are adjustable for each spindle position and are positioned automatically by the indexing of the spindle carrier. Pick-off change gears controlling speed of the work spindles are conveniently located at the rear of the right-end column. These gears provide a wide range of spindle speeds to suit various conditions of stock sizes and materials. The power feed brake controls the speed of the tool advancing mechanism, and prevents the tools from coasting into the work.

A special feature is the open end gearing for operating tapping, threading and high-speed drilling attachments. These gears are part of the attachments and are not part of the standard machine equipment. The universal slide, sometimes called the taper turner attachment, adds another cross slide to the machine and is capable of such operations as taper undercutting, necking and back-facing. It is mounted on the top bed and is operated by cams and a cam drum mounted on a projecting drum shaft at the left end of the machine. Auxiliary spindles, high-speed drilling attachments, threading attachments and tapping attachments also are available. This 3½-in. machine weighs approximately 36,000 lb., measures 133 in. long and 66 in. wide over-all without stock feed, and requires a 30-hp. motor. Maximum stock feed is 12 in. and turning capacity is 8 in.

"Prest-O-Weld" Blowpipe Has Detachable Valves

Retaining the detachable valve body construction which permits quick changing from welding to cutting, and from cutting to welding, the Type W-108 welding blowpipe offered by the Linde Air Products Co., 30 E. 42nd St., New York, N. Y., has individual mixers in each head, making correct flame adjustment easy. This construction also gives a definite resistance to flashback. The welding heads give a long, slender flame with a well-formed inner cone that permits thorough heating of even the bottom of the vee, and provides good control of the welding puddle. Special heads

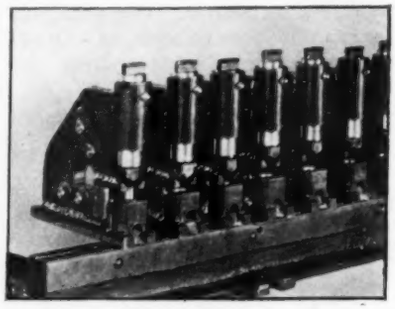


that confine the flame to a small area are available.

Included in this line of welding and cutting apparatus are the Type C-108 cutting blowpipe and the Type CW-108 cutting attachment. A lower preheat oxygen pressure permits a large flame for cutting very dirty or heavily scaled material. Like the welding blowpipe, these units have improved flashback resistance, are strongly built and are well-balanced for ease of handling.

Larger Multi-Unit Punches Available

A new size designated as the "Semco" No. 13½ A has been added to the line of multi-unit punches made by the Service Machine Co., 752 Broadway, Elizabeth, N. J., for use on press brakes having strokes up to 5 in. Illustrated are units with extra long pistons designed for long stroke travel with cylinders made longer and placed higher on the frame, designed to pierce holes up to $\frac{11}{16}$ in. in diameter in ½-in. thick mild steel. Center-to-center distance of the unit can be as small as 2½ in. Except for the shut height of the units, the No. 13½ A



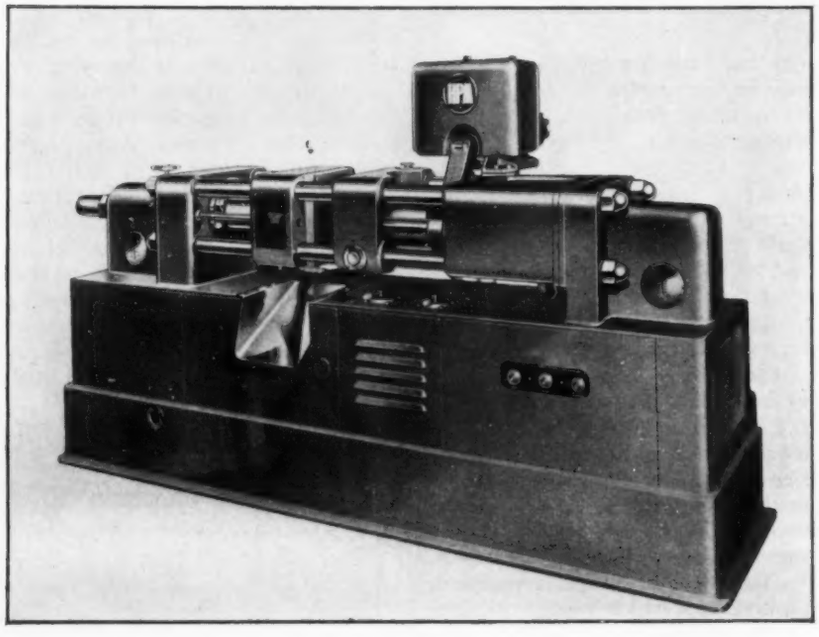
size is the same in all respects as the usual No. 13½ multi-unit punches, and provides a 6-in. depth of throat. Weight of each unit complete is about 35 lb.

Hydraulic Injection Molding Press Comprises Complete, Self-Contained Unit

The "H-P-M" Model No. 40-H-2 injection molding press developed by the Hydraulic Press Mfg. Co., Mt. Gilead, Ohio, is designed as a complete self-contained injection molding machine of the horizontal clamp type. It is actually two separate units consolidated into one press—an injection unit and a clamp unit, each having its own operating valves and controls.

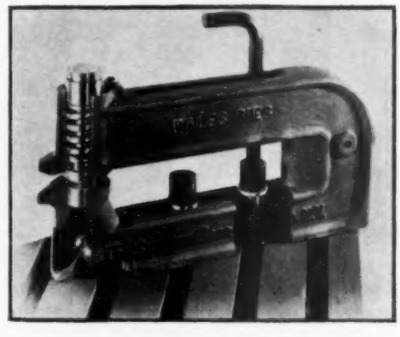
Injection unit consists of a nozzle with material chamber, automatic feed and hopper, and means of plasticizing the material. Clamp unit is an efficient, rapid acting horizontal press. It consists of a cylinder and a ram to which the traveling platen is fastened, four tie rods and a floating abutment which is controlled by two cushion cylinders. This direct-pressure hydraulic clamp provides follow-up pressure under heavy load. Clamping force is applied directly over the mold, and is under positive control. Clamp is automatically adjusted to molds of any thickness, so no clamp adjustment is required when changing molds.

Power equipment is mounted at the rear of the press in the base of the machine. Underneath is a reservoir containing oil for the operating circuits of the clamping and injection cylinders. Power unit consists of a 10-hp. motor connected by flexible couplings to two variable-capacity radial pumps. Both manual, semi-automatic and full-automatic control is provided through suitable pushbuttons.



"Wales" Die Holder Mounts on T-Slot Plates

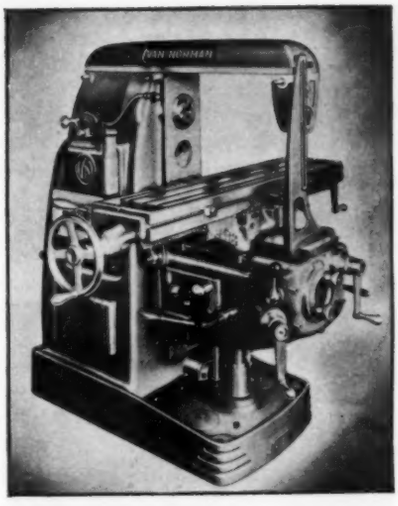
The Strippit Corp., 1200 Niagara St., Buffalo, N. Y., has developed its Type B perforating die holder especially for use on T-slotted plates, as it is provided with slots of sufficient length to allow increased flexibility of adjustment. Thus the dies may be located readily at any point within the area of the press ram, with each holder held to the plate by at least two bolts. In setting up these dies, a



template is inserted into the throats of the holders and the punches are made to engage holes in the template, after which the holder is fastened to the plate.

Van Norman Introduces Light Milling Machine

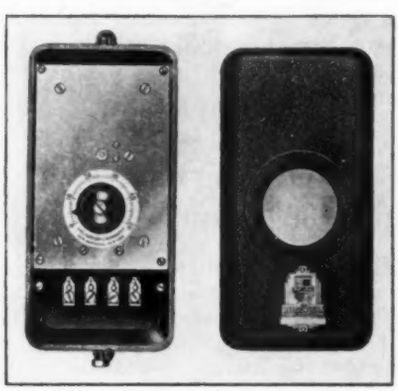
Van Norman Machine Tool Co., 160 Wilbraham Ave., Springfield, Mass., has announced its fourth milling machine to be placed on the market within the last two months. Known as the Model No. 2-L, it is a light model miller, plain or universal, designed for rigidity and dependability.



Provided are front and rear controls, six-way rapid traverse and a wide range of speeds controlled by a single-lever selector. Machine has eighteen spindle speeds ranging from 30 to 1,450 r.p.m. and twelve table speeds ranging from ½ to 36 in. Table size is 45 x 10 in.

Time Delay Relay Offered By Partlow

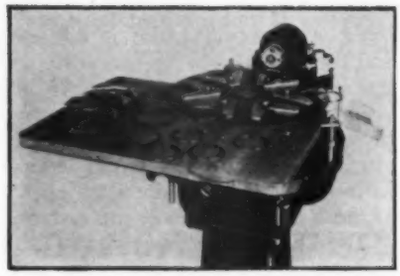
The Partlow Corp., 2 Campion Rd., New Hartford, N. Y., has developed the model 308 self-contained time delay relay for automatically starting or stopping a process cycle after a predetermined lapse of time. It is driven by a self-starting synchronous clock motor and contains a clutch which is engaged by the electromagnet. When the time delay relay is energized, the magnetic clutch will engage and the timing motor will start. At the end of the cycle, a micro switch operates to stop the timing motor and to make or break the load circuit, depending upon which type of switch is used. The knob on the front of the relay is set easily to the time interval desired by loosening a clamp screw and turning the knob to the desired setting. When the relay is energized by closing the main switch, the pointer travels over the scale, indicating the remaining amount of the timing period, until the pointer reaches zero on the scale.



Power Marking Machine Handles Precision Work

Developed by the Noble & Westbrook Mfg. Co., 20 Westbrook St., East Hartford, Conn., the power-operated precision marking machine illustrated has been designed to make inscriptions on the sides of piston rings ranging in size up to approximately 5 in. in diameter. Because the rings are machined very accurately and some of them are quite delicate, it is necessary to mark them with a light uniform impression which will not distort or crack them.

A sensitive adjustment permits setting the marking die to penetrate the ground surface of the ring to a depth of approximately 0.002 in. or deeper as desired. Marking die revolves continuously and is timed so that an impression is made as each ring passes under it. Rings are carried to the marking die on a revolving dial, and after the marking operations they are unloaded automatically. A burnishing roll removes burrs around the impression, so that the rings leave the machine within 0.00025 in. of their original thickness.



"Ekko" Process Produces Dies by Plating

The "Ekko" process for producing molds and dies by electroforming iron against a pattern has been developed by the United States Rubber Co., 1790 Broadway, New York, N. Y., as an outgrowth of researches on the production of cheaper tire molds. By this process, an iron mold can be made direct from practically any material, including wood, rubber, glass, plastics and all materials except aluminum and zinc, which are attacked by the plating bath. Non-metallic patterns are first rendered conductive by dusting with a powdered graphite and polishing vigorously with a light brush.

Electroforming is virtually the same as electroplating, except that deposits up to ½ in. thick are produced instead of the usual 0.001–0.002-in. coatings. When the heavy electroformed deposits of iron are separated from the underlying pattern, a cavity or die insert is obtained which has reproduced the shape and surface finish of the pattern in microscopic detail. This cavity or die when properly mounted may then be used to mold or stamp objects from glass, rubber, plastics and sheet metal.

Iron produced by the electroforming process is 99.98 per cent pure and substantially free from porosity. It is about 50 per cent harder than cold rolled steel and gives a scleroscope reading of 37 or a Brinnell reading of 240. The metal can be softened to the normal value of pure iron by annealing or can be hardened by carburizing so that it will scratch glass. It has a heat conductivity nearly twice that of cast iron or steel, which is often an advantage in molding operations where a high rate of heat transfer is desirable.

Illustrated is one of the simplest applications of the new process. Using a Bakelite radio dial dusted with graphite as a pattern, the cavity shown was electroformed. The plated metal was approximately ¼ in. thick and was mounted for use by machining the back to a suitable shape and inserting the electroformed cavity into a steel block which had been hollowed out to receive it. The other half of the mold was prepared and mounted in the same manner. Dial

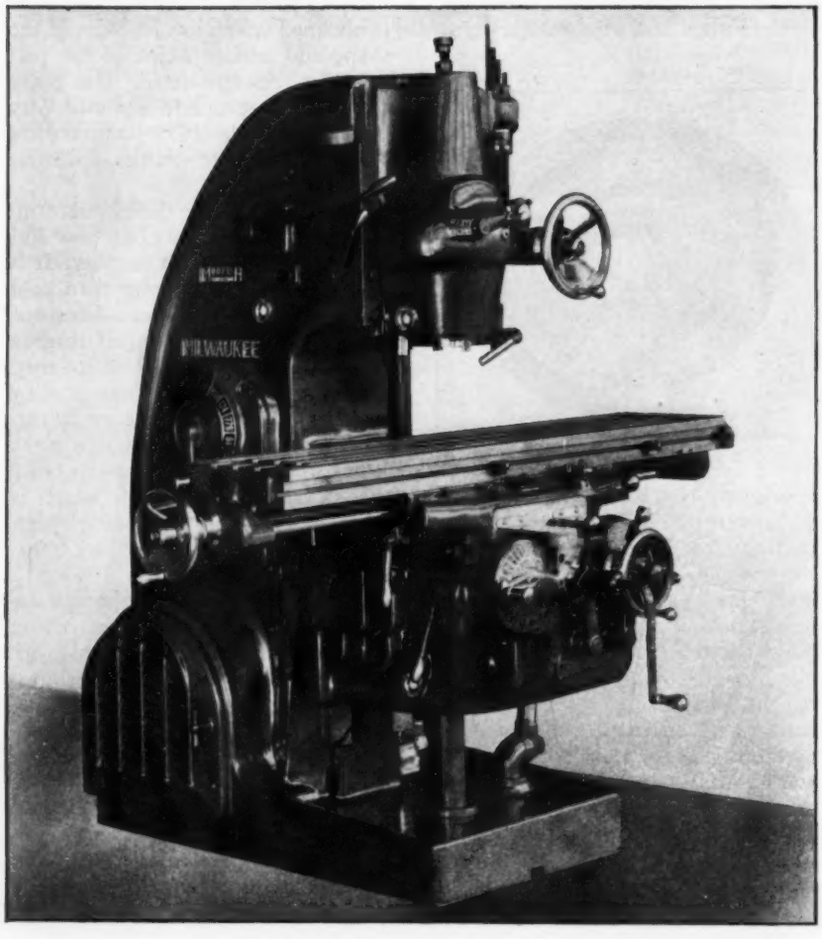
scale and numbers are raised in the mold, a condition which is difficult and costly to obtain by engraving as the metal surrounding each scale division or number must be cut away to leave the raised portion. By the electroforming process raised letters in the die can be produced as easily as those depressed below the surface.

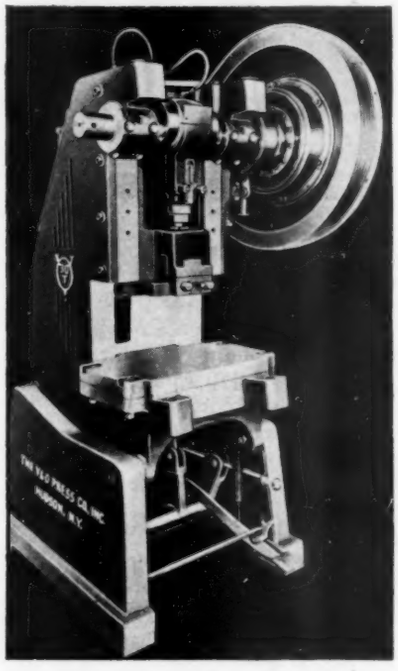
The "Ekko" process is also of advantage in preparing both dies and forces for embossing sheet metal. A die is first prepared in the usual "Ekko" manner and then additional non-adhering metal is plated into the cavity until this deposit is as thick as the embossing to be produced. It too is then treated for non-adherence and ¼ in. or so of metal plated into it to form the force. The three pieces are then separated and the center section discarded, leaving the completed die insert and force insert. By this method, detail is preserved precisely on the face of the embossings but is slightly obscured on the back. However, this is usually of no importance in this type of work.

Models 3H and 4H Millers Added By Kearney & Trecker Corporation

Augmenting the "Milwaukee" Model H line of milling machines are the Models 3H and 4H machines offered by Kearney & Trecker Corp., Milwaukee, Wis. These machines are available in plain, universal and vertical types and have the conventional specifications in accordance with their sizes. The No. 3H miller requires a 7½ hp. motor, while 10-hp. motor is used in the No. 4H machine.

These machines embody standard Kearney & Trecker features, such as solid back column, pump-mounted motor, Sponson-type knee, center bearing spindle mounting, double overarms and wide range of speeds and feeds. Two ranges of sixteen speeds are available, 20 to 1,000 r.p.m. and 30 to 1,500 r.p.m. in a 50-to-1 ratio, for both sizes in one complete single series. The feeds range in a complete single series, 60-to-1 ratio, from ½ to 30 in. per min. for longitudinal and cross feeds, and ¼ to 15 in. per min. for vertical movements. There are sixteen feeds in the series. Power rapid traverse with spindle stopped or running is 150 in. per min. for longitudinal and cross movements and 75 in. per min. for vertical movements.



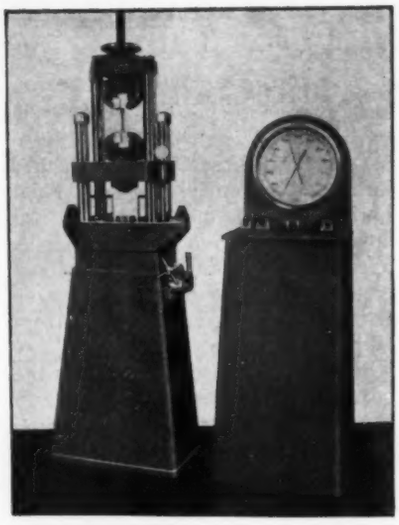


Inclinable Press Runs at High Speed

Announced by the V & O Press Co., Hudson, N. Y., the Model No. 30-T inclinable press utilizes a ball-actuated, self-energizing friction clutch which affords an infinite number of engaging points. Design includes provisions for overload release and for backing up. A directional panel is provided for centralized controls of the built-in clutch lock, single stroke clutch (adjustable for continuous operation) and fully releasable or constant brake. Improved loop type safety guard and ball bearing mounted web type flywheel are included.

Detroit Universal Tester Has Floating Table

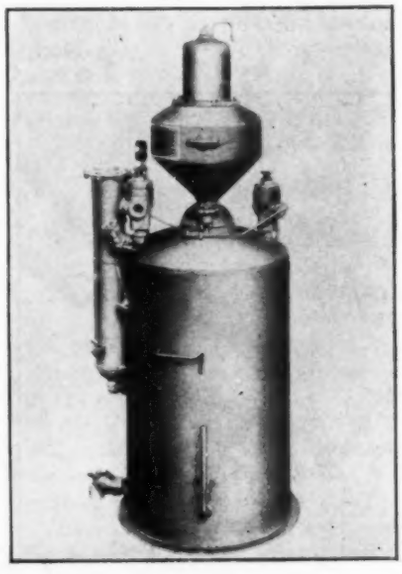
Having 60,000-lb. capacity, "Universal" testing machine announced by Detroit Testing Machine Co., 5137 Trumbull Ave., Detroit, Mich., is arranged for tensile, transverse, and



compression testing. Load is applied hydraulically, the pump, motor reservoir and piping being located in the base of the machine. Rate of loading is automatically maintained by an auxiliary valve which may be set to suit varying conditions. The transverse table, posts and head are full-floating, while tensile testing, eliminating any possibility of misalignment of specimen or friction in the ram. For transverse or compression testing, the floating unit is guided in a rigid manner. Standard ram travel is 4 in.

Unit Generates Acetylene At Medium Pressure

The Linde Air Products Co., 205 E. 42nd St., New York, N. Y., has designed its "Oxweld" Model MP-9 medium-pressure acetylene generator especially to combine portability with the operating advantages usually found in larger units. The new model weighs only 129 lb., and holds 25 lb. of size 14 ND Union Carbide. It will deliver as much as 50 cu.ft. of acetylene per hour at any desired pressure up to 15 lb. per sq.in. Operation of the generator is claimed to be simple, since only one handle is used to control generation of the gas and to adjust delivery pressure. After starting, the generator is fully automatic in operation.



Bliss 750-ton Four-Eccentric Press Developed for Automobile Stampings

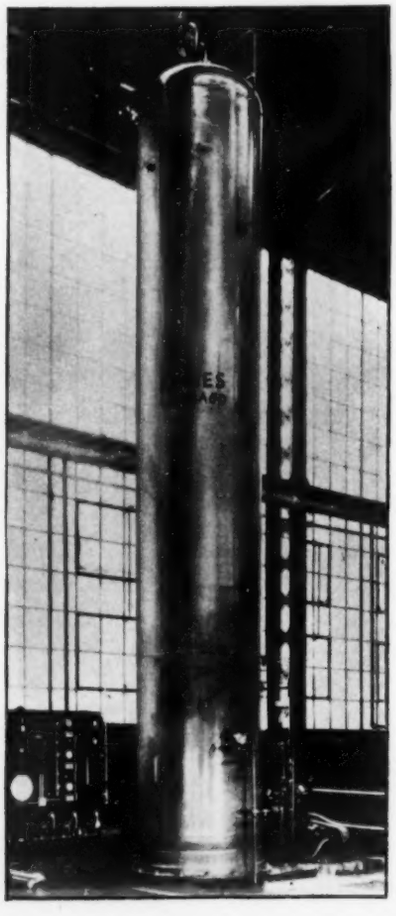
Having a rated capacity of 750 tons while operating at 14 strokes per minute, the Model 4-E-10-120 presses built by the E. W. Bliss Co., 63rd St. and 2nd Ave., Brooklyn, N. Y., has been developed especially for the automobile trade and the stamping field. The press illustrated is of the four-eccentric type, the slide being actuated by a connection to each corner which is in turn driven by an eccentric. Eccentric shafts run front to back with the main bearings mounted in the heavy crown ribs, distributing the thrust load throughout the crown. Press is double-geared with herringbone steel gearing throughout the main drive, twin driving gears on the crankshaft, and with all gears running in a bath of oil.

Clutch is of the latest improved design and is operated by electric push-button control. Flywheel is mounted on Timken roller bearings and can be stopped after the power has been shut off by means of a brake. Slide is precision gibbed at all four corners, and has barrel-type connections to give an adjustment of 6 in. by means of an electric motor. Counterbalance cylinders are mounted in the uprights and bed to preserve the lines of the ma-

chine. Model shown has a bed area of 80 x 120 in. Die space is 60 in., and stroke of the slide 24 in. This design is available in many different sizes of four types.

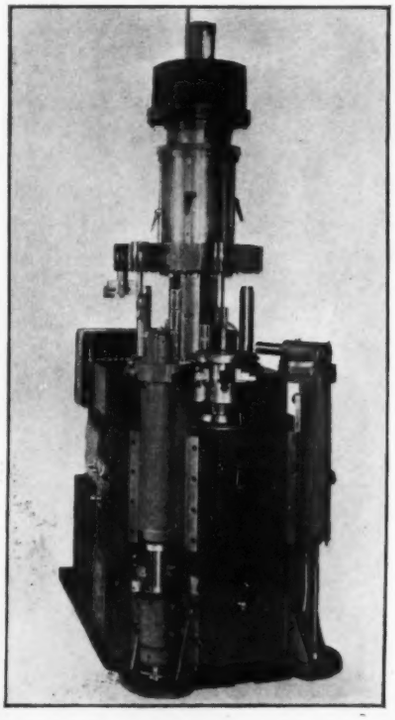
Hydraulic Accumulator Uses Air for Ballast

The air-ballast pistonless type hydraulic accumulator, manufactured by the Charles F. Elmes Engineering Works, Morgan and Fulton Sts., Chicago, Ill., has a capacity of 275 gallons at 2,500 lb. working pressure. Because of its light weight this type of accumulator does not require a pit or heavy foundation. Line shocks common with the weighted type are avoided with the air-ballasted type, and variations in pressure are said to be avoided. Maintenance costs are reduced by elimination of internal packing, and the necessity of periodically exhausting the air and liquid is avoided because there



are no internal moving parts to get out of order. The pressure vessels conform to all safety codes and the controls are simple, automatic and positive.

Springfield Vertical Turret Lathe Provides Full Automatic Control



Full automatic control of the six-faced turret and two side heads adjacent to a central chuck is provided in the vertical turret lathe announced by the Springfield Machine Tool Co., 631 W. Southern Ave., Springfield, Ohio. With the exception of the turret indexing, which is by gearing, all movement of turret and side heads are hydraulic, with electric controls.

These controls are mounted on top of the machine body directly to the rear of the column. They consist of a six-sided drum, mechanically connected to the turret, which carries contacts to operate the Vickers control panel for the turret and to energize the solenoid valves controlling the side heads. Movement of the turret is selectively controlled for each face by adjustable contacts on the corresponding face of the control drum through rapid advance, cross feed, fine face, stop, dwell, rapid return and index. A simple adjustment permits indexing past one or more faces of the turret should it be necessary. Turrett is indexed by a system of intermittant self-locking gearing driven by an independent motor mounted on top of the columns, and is kept in register during its travel by two heavy guide pins.

Vertical movement of the turret is approximately 14 in. Side heads have a vertical movement of 9 in. and a horizontal movement of 3½ in. Their horizontal range may be adjusted for any part of a 16-in. diameter circle. Special valves convenient to the operator permit the head cycles to be selected for either vertical or horizontal motion.

Body of the machine contains the gearing and the spindle, which has 18 speeds ranging from 10 to 1,750 r.p.m. Change gears, back gears and spindle are constructed as three separate assemblies, any one of which may be removed as a unit without dismantling the machine. Body of the machine is of welded steel, mounted on a heavy cast-iron base which, in turn, is mounted on a welded steel base housing the drive motor, oil reservoir, pump and necessary valves and pipes. All bearings are Timken equipped, and bearings and gears are lubricated by a force-feed system. Weight is approximately 6,000 lb.

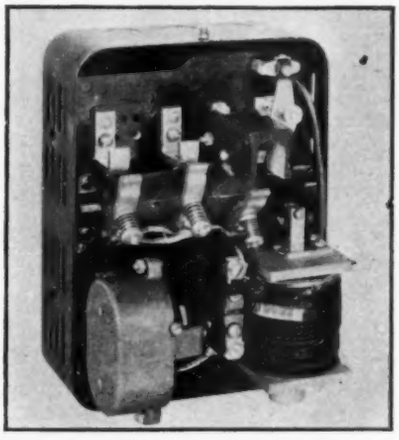
"Thor" Air Grinder Weighs Only 18-oz.

The Thor "Bantam" rotary air grinder for small-wheel work announced by the Independent Pneumatic Tool Co., 610 W. Jackson Blvd., Chicago, Ill., is only 5½ in. long and weighs but 18 oz., a combination of features which makes it easy to handle for most precision work. Operating at a free speed of 14,000 r.p.m., this unit is suitable for use with a wide variety of accessories. Mounted abrasive wheels in all shapes and sizes from the smallest pointed wheel up to those 1½ in. in diameter can be used efficiently. Device

is claimed to maintain a nearly constant speed under load, with low operating and maintenance costs. Standard equipment includes a pushbutton throttle which may be locked for continuous operation of the tool, a ¼-in. collet, and a swivel hose connection.

Definite-Time Starters Made for D.C. Motors

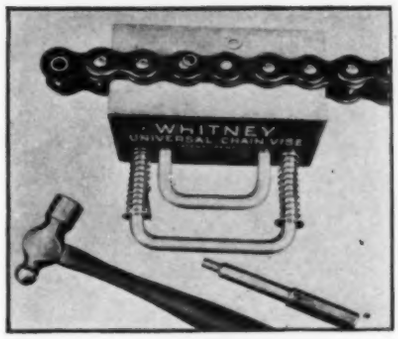
General Electric Co., Schenectady, N. Y., has announced development of a line of d.c. mechanical time starters for general purpose constant-speed motors where jogging is not required. Rated at 5 hp., 115 volts, and 10 hp., 230 volts, these starters consist of a solenoid-operated multi-finger contactor with an overload re-



lay. A time-delay escapement mechanism, in constant engagement with the operating shaft, restrains the shaft in the starting motor but permits quick opening through action of a positive over-running clutch. Overload relay works on the heater and bi-metallic strip principle, and is easily adjusted for either manual or automatic reset.

Roller Chain Vise Handles Many Sizes

Developed to simplify the installation and repair of cottered or riveted roller chains, the universal chain vise offered by Whitney Chain & Mfg. Co., Hartford, Conn., enables one man to easily disassemble the chain at any desired point without damage to chain parts. Vise is opened with one hand and the chain placed into the jaws, which accommodate any pitch chain from ⅝ to 2½ in. inclusive. Upon releasing, spring tension clamps the chain accurately into position,



leaving both hands free for the dissembly operation. In the case of riveted type chain, a few blows of a hammer on the rivet heads forces them through the plate and shears off the head in washer form. With this tool it is also possible to repair a chain without removing it from the sprockets, since the spring tension will hold the tool in position and the weight of the vise is sufficient to act as an anvil.

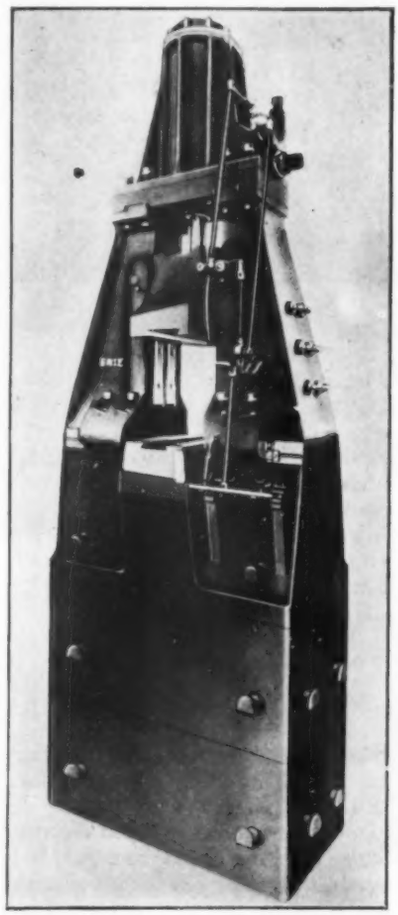
Erie Steam Drop Hammer Forges Exceptionally Long Sections

Claimed to be the largest ever built for use in this country, a mammoth steam drop hammer installed in a Midwestern city and built by the Erie Foundry Co., Erie, Pa., has been designed to make long forgings. Special construction was used to permit successful use of the long dies involved, and the control system incorporated in the design is said to permit best results to be obtained when working with light metal alloys.

Rated as a 35,000-lb. hammer, this machine has an actual weight of ram, rod and piston of about 42,000 lb., and will handle, in addition, a top die weighing 10,000 lb. Total weight of the machine is about 440 tons, of which 350 tons is in the anvil. Top section of the anvil weighs 130 tons and each bottom section weighs 110 tons. Over-all height of the unit is over 40 ft., although only about 23 ft. will be above the floor line when installation is complete.

Control is by means of a single foot treadle, with an auxiliary hand lever which can be operated either alone or in conjunction with the treadle. All control functions are handled by this lever or treadle. Machine is fitted with a throttle control by means of which the openings of the throttle valve for a given position of the control lever can be varied to govern the speed of oscillation and the force of the blow. Hammer strikes at the rate of 50 blows per minute, with a total reciprocating weight of more than 15,000 lb., and with provision for injecting the steam above the piston to increase still further the force of the blow.

Dies up to 44 in. wide can be used, and can be supported without overhang up to a length of 90 in. Since dies longer than this will be used regularly, special construction has been employed to prevent angular misalignment. Extensions of the anvil supports the long sow block without any overhang, and dies slightly longer than the sow block may be used successfully. In each hammer

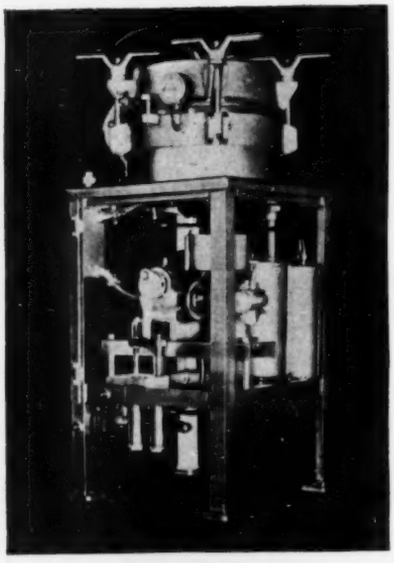


frame are provided two separate guides which can be independently adjusted to provide the necessary running clearance between the ram

and the guide, and still have all the clearance on one side at the instant of impact to prevent the ram and top die from twisting when forging warped surfaces.

"Hilco" Oil Reclaimer Requires Little Attention

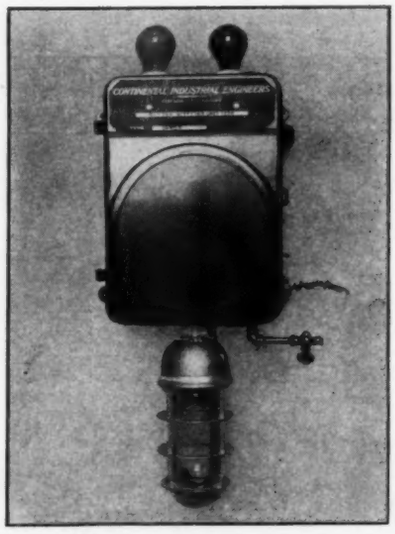
Only once a day is attention required to the Model B "Hilco" oil reclaimer developed by the Hilliard Corp., 31 W. 4th St., Elmira, N. Y. The unit operates on the same principle as the company's larger models, being continuous, all-electric and completely automatic in operation. Capacity ranges



from 6 to 50 gallons per day, depending on the type of oil to be purified. The process consists of filtration through a bed of efficient adsorbent clay to remove all solid matter such as sludge, carbon, abrasives and dust. Moisture and fuel dilution are taken care of by evaporation under vacuum in a vaporizing chamber which is electrically heated and thermostatically controlled.

Continental Detector Checks Gas for Oxygen

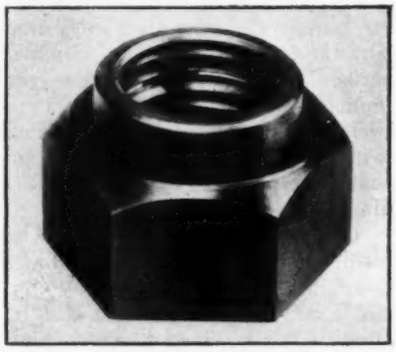
The oxygen detector offered by Continental Industrial Engineers, Inc., 201 N. Wells St., Chicago, Ill., is designed for continuously and automatically checking atmosphere gas. It is used in various types of installations for checking the inert gas supply to prevent fires, explosions or damaged product. The device is arranged to take a continuous sample of atmosphere and pass it through a monitoring device. This unit acts in such a



manner that a substantial trace of oxygen will immediately operate a relay, closing down the unit and flashing a red signal light as well as ringing a signal bell. When in normal condition and no oxygen is present, a blue light is shown by the device. The detector is fully automatic, and after it has shut down the unit, the unit will not automatically restart until it has been manually inspected and checked.

Self-Locking Nut Resists Vibration

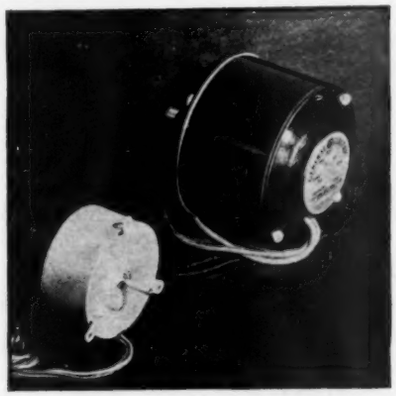
Lamson & Sessions Co., 1971 W. 85th St., Cleveland, Ohio, has made available a self-locking nut designed for use where fastening is difficult because of shock and vibration. It is simple in design with automatic locking action which does not depend upon special threads, springs, pins or other extra parts. Locking portion of the nut consists of a raised crown section, slotted perpendicular to the nut axis. This section is distorted so as to form an elliptical ring section. When applied, the nut spins on the bolt until the threads meet the locking crown. The nut is then wrenched on, forcing the crown to assume the circular cross section of the bolt. It is



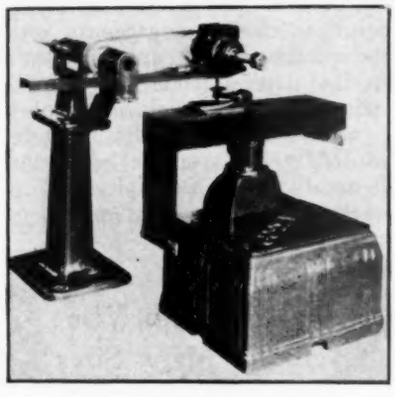
claimed that the nut can be applied repeatedly without loss of locking action and without harming the bolt thread. It can be furnished in aluminum and aluminum alloys, brass, bronze and stainless steel.

Synchronous Motors For Small Applications

A line of fractional horsepower a.c. capacitor motors has been developed by the General Electric Co., Schenectady, N. Y., for use on indicating and recording instruments, small regulat-



ing or control devices, remote control devices, and similar applications. Available in two frame sizes, they are of the synchronous self-starting inductor motor type. Six sizes provide from 75 oz.-in. torque at 75 r.p.m. to 12 oz.-in. at 4 r.p.m. The three smallest sizes are of the geared-motor design.



Attachment Polishes Flat Surfaces

An attachment arranged to be used in connection with an ordinary polishing lathe, designed by C. B. Larson, 27 Tuscan Rd., Maplewood, N. J., is said to finish flat surfaces at a high production rate by grinding, polishing or buffing. The oscillating spindle is mounted on a balanced floating arm,

"MODERN" MEANS MORE THAN MERELY "NEW" IN THE DESIGN OF MILWAUKEE MILLING MACHINES

CHANGES and developments in milling machine design must be more than merely "new" to measure up to the K&T concept of what is "modern" . . . If the "new" offers definite improvements in performance — proven by exacting tests on actual work — K&T engineers pass on these benefits to milling machine users . . . Only by such careful analysis and practical tests can basic progress in milling machine design be made . . . Concentrating on the building of milling machines exclusively—for more than 41 years—has won for the Kearney & Trecker Corp. world-wide recognition for the most advanced milling machine design and construction.

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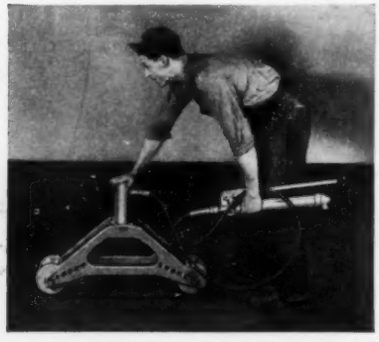
which is equipped with depth of cut adjustment and pressure control. Reciprocating table is mounted on an individual heavy base and is gear-driven by a ¼-hp. motor. Table is controlled by a foot-operated switch, which also automatically raises and lowers the wheel into the work, leaving both hands free to remove or replace work. Work table is 6 x 8 in., but will accommodate holding fixtures up to 7 x 12 in. Maximum stroke is 12 in. Normal traverse speed is 15 ft. per min.

"Porto-Power" Unit Bends Seven Sizes of Pipe

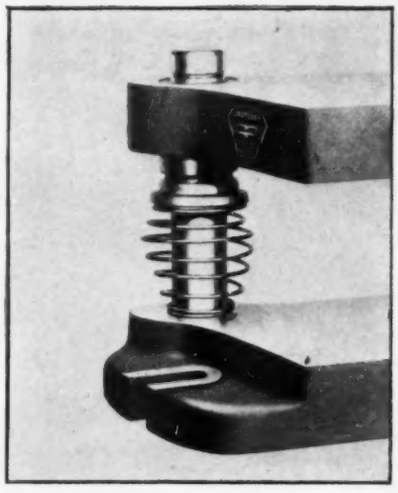
Using a 20-ton hydraulic unit, the "Porto-Power" pipe bender announced by the Blackhawk Mfg. Co.,



Milwaukee, Wis., handles seven sizes of rigid conduit and pipe ranging from 1¼ to 4 in. in diameter. Known as the Model S-36, this unit weighs only 190 lb. and has a simplified one-piece bending ram which eliminates numerous extension bars, tension arms and other parts usually used. Its hydraulic unit can be removed from the bending frame and used with special attachments for pulling gears and pulleys, or for lifting over long spans at any angle. The unit can be moved to the job easily.

Oiler Lubricates Die Set Leader Pins

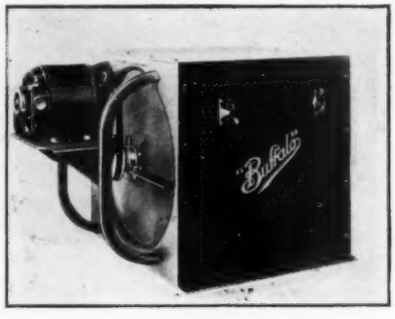
E. A. Baumbach Mfg. Co., 1812 S. Kilbourn Ave., Chicago, Ill., has developed an automatic die set leader oiling system which is applicable to any make of die set. Oiler consists of two simple units comprising a compression spring and an oil retaining ring. Ring is made of steel and embodies an absorbent wick which fits around the leader pin and rides up and down by movement of the punch press. The spring, acting as a booster, lifts the ring to sufficient height on the up-stroke to assure spreading a film of oil on practically the entire



length of the pin. Oilers are available in sizes to fit leader pins from ¾ in. to 3 in. in diameter, with spring lengths of 2½, 4, 6, and 8 in.

Buffalo "Breezo" Fans Made in Seven Sizes

Type L "Breezo" fans offered by Buffalo Forge Co., 448 Broadway, Buffalo, N. Y., are arranged so that the driving motor is not in the path of the air handled. This arrangement is desirable where there is an excess of moisture, heat, dust or fumes, or where it is desirable to have the motor removed from a closed system. With the V-belt drive employed, it is easy to change the fan speed and motor



drive when conditions require more air against high resistance.

The motor, V-belt, pulleys and one bearing are entirely outside of the path of the air being handled. Housings are so designed that the air inlet may be at the top, bottom or either side of the unit, and may be changed from one to another on the job if necessary. The seven standard sizes range from 12 to 36 in. fan diameter with motors ranging from ⅛ to ¾ hp. The 12-in. size will deliver 1,080 cu.ft. per min. of free air while the 36-in. size has ten times this capacity.

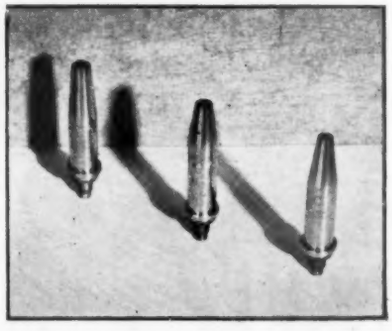
Cover Respirator Has Improved Filters

The No. 40 "Skin-A-Cat" respirator, offered by H. S. Cover, Station A, South Bend, Ind., features a filter construction that does not require filter retaining plates. Filters are held in place by adjustable tubular connections. There is 40 sq. in. of filtration area. The filters resemble miniature sofa cushions which always stay flexed without the use of spacing devices or dividing segments. Filters of this design are said not to choke or collapse,

and to make possible a free breathing condition. These advantages are obtained by sewing the filters together and then turning them inside out before attaching to the respirator face piece. Two check valves and an exhalation valve are provided.

Oxweld Cutting Nozzles Have Polished Passages

The Linde Air Products Co., 30 E. 42nd St., New York, N. Y., has made available a series of precision "Oxweld" cutting nozzles which are claimed to make cuts of such quality that usually no subsequent machining is required. These nozzles are designed for use in "Oxweld" machine cutting blowpipes, Types C-35, C-37,



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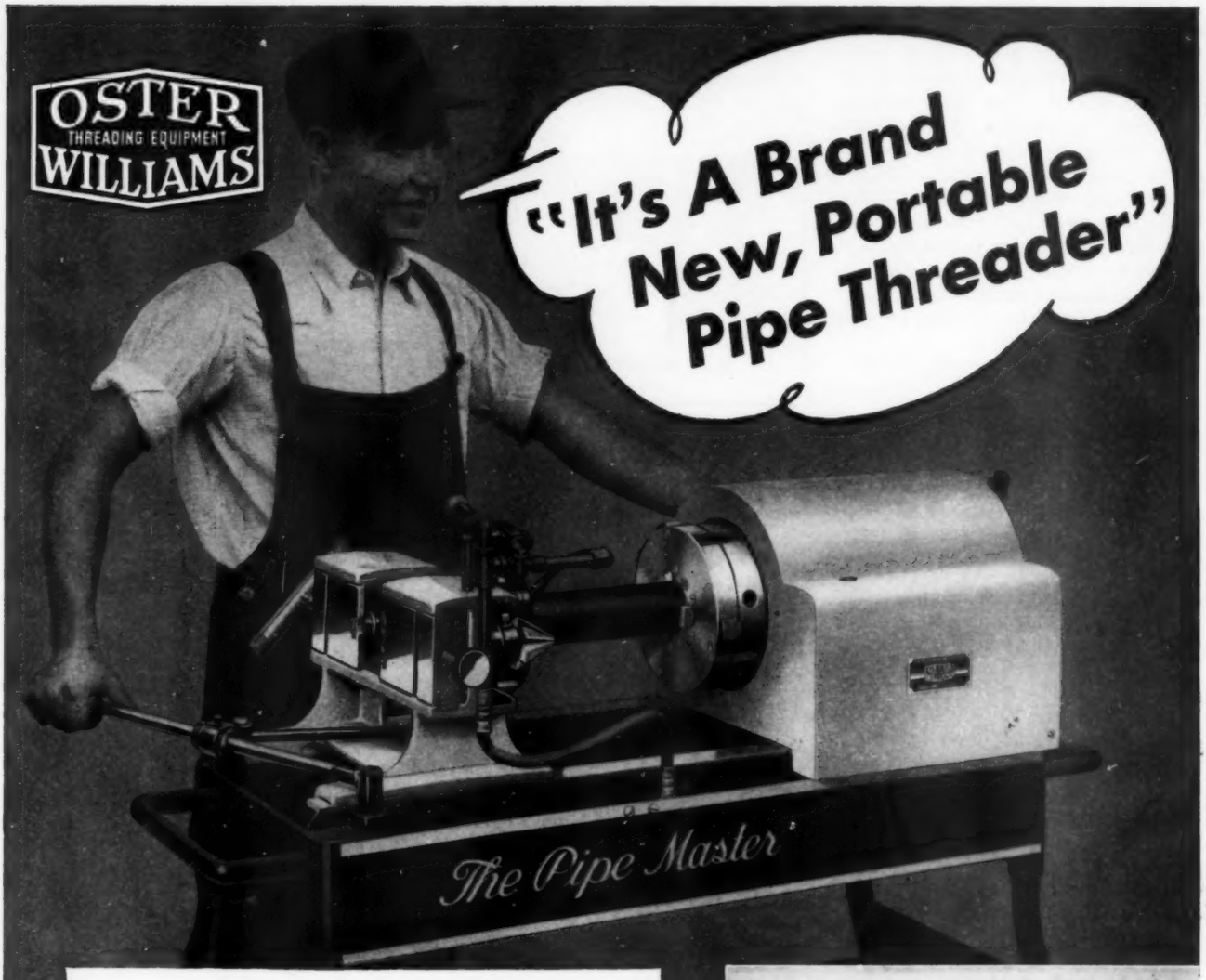
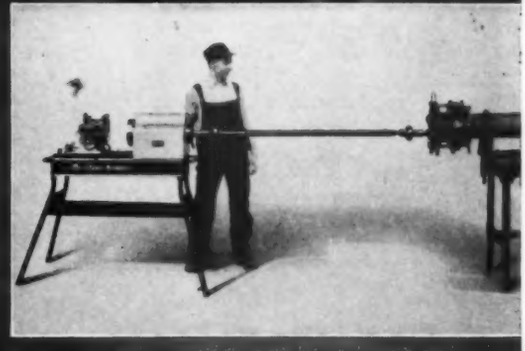
"It's A Brand New, Portable Pipe Threader"



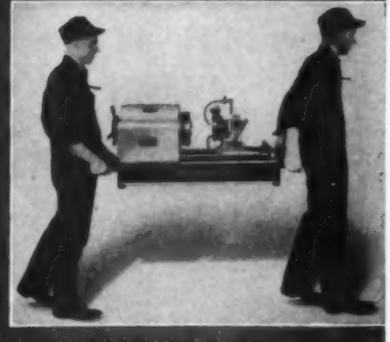
The NEW "Pipe Master" has everything that you, yourself would build into a portable pipe machine. . . .

1. Fast operation — up-to-the minute streamline design. **2.** Full range — ¼" to 2" and up to 6" with drive shaft. **3.** NEW, sliding-type, die-head — fully adjustable. **4.** NEW, fluted reamer integral with front of die-head — convenient to use. **5.** NEW, cut-off device — all steel — powerful and quick-cutting.

Ask your jobber for a demonstration, or fill in the coupon below for List No. 24, describing the "Pipe Master."



The "Pipe Master" threads 6" pipe with drive shaft and geared die-stock



It's SAFE and EASY to carry the "Pipe Master" with its motor

YES! I am interested in your NEW "Pipe Master." Please send me your List No. 24 and your low delivered price.

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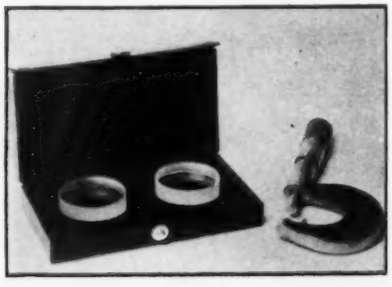
C-39 and C-48. Among the features claimed to improve the quality of these nozzles are: (1) a highly polished cutting oxygen passage which produces a smooth gas flow without deflection or turbulence, (2) preheat holes are smaller and spread over a larger circle so that the head is less concentrated on the line of cut, resulting in a sharper upper edge, a smaller kerf, and a saving in preheat gases, and (3) the cutting oxygen passage is exactly vertical, so that when cutting shapes or circles, the face of the cut is true all around.

Optical Parallels Check Micrometer Accuracy

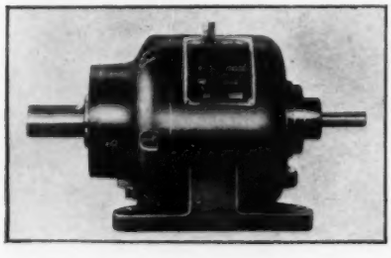
A set of optical parallels has been developed by the Van Keuren Co., 12 Copeland St., Watertown, Mass.,



especially for checking the flatness and parallelism of the faces of micrometers, measuring machines and other instruments by the light wave interference method. Set includes two parallels 1¼ in. in diameter, flat and parallel within 0.000005 in. One parallel is approximately 0.0125 in. thinner than the other to permit checking micrometer anvil parallelism at more than one point on the adjusting screw.

Smith No. 7 Reducer Uses Anti-Friction Bearings

The No. 7 unit added to the WHS line of differential speed reducers offered by Winfield H. Smith, Inc., Springville, Erie Co., N. Y., has anti-friction bearings throughout, including Timken bearings on both high-speed and low-speed shafts. Ratios of reduction are obtainable up to 20,000-to-1 with torque capacities ranging from 2,000 to 5,000 inch-pounds.

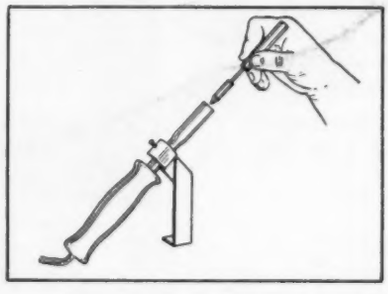


Lyon Utility Truck Features Easy Loading

Rollers have been provided on the platform of the utility truck developed by the Lyon Iron Works, Greene, N. Y., to promote easy loading and unloading. Redesigned to improve the location of the rollers, this model has roller-bearing wheels and is of all-welded construction, with the exception of the handle, which is bolted to facilitate shipping. Tilting feature permits exceptionally easy unloading, as the truck is simply tilted and the load rolls off. Standard size is furnished with a platform 22 x 33½ in., 5 in. high. Weight is about 100 lb.

Pencil Soldering Iron Does Delicate Work

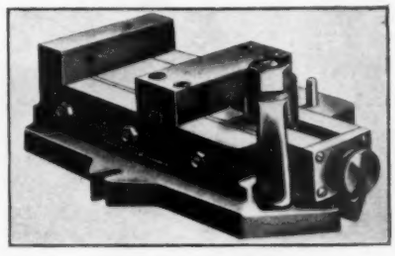
The need for small soldering irons of the pencil type for work such as on radio sets and other electric appliances is claimed to have been met



satisfactorily by the Electric Soldering Iron Co., Deep River, Conn. A regular "Esico" No. 54P or 96P soldering iron is fitted with a bracket to hold the iron on the bench, while a pencil iron is inserted in place of the regular tip ordinarily used. Thus the unit heats the pencil iron quickly and keeps it at the proper temperature for instant use.

New Production Vise Helps Increase Output

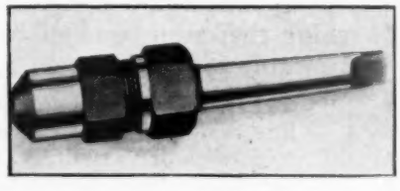
Announced by the Chicago Tool & Engineering Co., 8389 S. Chicago Ave., Chicago, Ill., the 2½-in. production vise recently added to the "Palmgren" line of angle and production vises is intended especially for high production in connection with milling, drilling and grinding operations. Vise has an adjustable cam locking



lever which works against a hardened steel surface, permitting rapid loading and unloading. It is also equipped with a handscrew for quick adjustment when a change to a different size piece is necessary.

Precision Collet Chuck Has Only Four Parts

A collet-type precision chuck for drills, end mills and similar tools, said to possess unusual grip and extreme ease and accuracy of set-up, is being



manufactured by Erickson Steel Co., E. 80th St. and Bessemer Ave., Cleveland, Ohio. Chuck consists of only four parts—shank, shank grip-nut, collet and nose piece. All working faces, hole concentricities, bearings and angles are held to a tolerance of 0.00001 in. Collet is inserted in the shank and the nose-piece tightened down upon it by means of the shank grip-nut, thus avoiding possibility of twisting the collet.

"Protect-O-Metal" Improves Welding and Die Casting

"Protect-O-Metal," a compound manufactured by G. W. Smith & Sons, 2016 E. Third St., Dayton, Ohio, is

claimed materially to increase the quality of welded or die cast articles by prevention of corrosion and adhesion. When brushed on a surface to be welded, it prevents corrosion and adhesion of spatter, and after the weld is completed all spatter and surface oxides can easily be removed by wiping the surface with a cloth or washing with water. "Protect-O-Metal" is said to form an ideal priming coat for a paint finish. When "Protect-O-Metal" is sprayed or brushed on a die-casting die it forms a heat-resistant coating and prevents the molten metal from sticking to the die. Its use is claimed to prevent core pins from breaking off or being worn undersize or galled because of shrinkage of the molten metal, as sometimes occurs in the casting of aluminum. It is said to be equally effective for deep drawing dies, permanent molds and drop forging dies.

Plating Rack Insulation Speeded with "Miccrolite"

"Miccrolite", a protective coating material for insulating plating racks introduced by the Michigan Chrome Co., 6340 E. Jefferson Ave., Detroit, Mich., can be applied rapidly and will air dry quickly. Developed as an all-purpose protective material for plating racks and used in any solution for any process, it is claimed not to be affected through the complete cycle of plating, and to be effective in all types of cleaning operations. It is of low viscosity to permit application of extremely thin yet effective coatings.

TRADE PUBLICATIONS

CIRCUIT BREAKERS 32 pages of data concerning FH steel-clad circuit breakers is provided in Bulletin No. GEA-3143, issued by the General Electric Co., Schenectady, N. Y.

DRILLS Bulletin No. 2963-C, published by the Buffalo Forge Co., 448 Broadway, Buffalo, N. Y., describes the features of new No. 15 heavy-duty and manufacturing type sensitive drills, tappers and accessories.

FURNACE APPLIANCES Booklet No. 601, published by the American Gas Furnace Co., Elizabeth, N. J., contains 32 pages of illustrations and specifications concerning an extensive line of small industrial gas furnace appliances. Also included are several valuable reference tables.

HOISTS Bulletin No. 138, issued by the Chisholm-Moore Hoist Corp., Tonawanda, N. Y., describes and illustrates features of the "Comet" electric hoist.

INSTRUMENTS Bulletin No. 525, issued by the Bristol Co., Waterbury, Conn., discusses a line of humidity recorders and controllers.

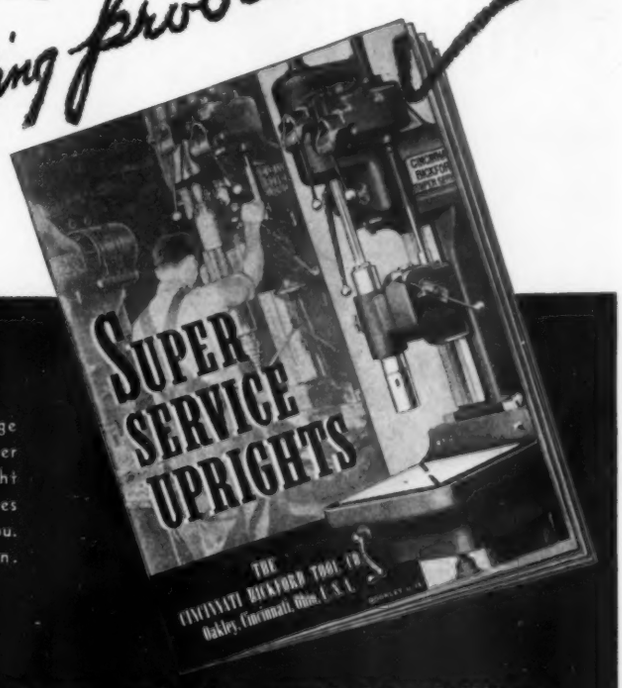
LIQUID METERS Bulletin No. 40B-15, issued by Roots-Connersville Blower Corp., Connersville, Ind., describes cycloidal rotary displacement liquid meters and motors.

LUBRICATION Methods of lubricating for life small devices lacking continuous oil supply are covered in Technical Bulletin No. 102, available from Acheson Colloids Corp., Port Huron, Mich.

LOCOMOTIVES Bulletin No. GEA-3071A, issued by the General Electric Co., Schenectady, N. Y., provides eight pages of information concerning a new line of diesel-electric industrial locomotives.

MANGANESE STEEL American Manganese Steel Div., American

Send for this— it will help solve your drilling problems!



The new 24-page catalog of Super Service Upright Drilling Machines is ready for you. No obligation.

The efficiency of the upright drilling machines in your shop may determine your chance for worthwhile profit in 1940. Now is the time to investigate these most modern machines. Write for Booklet U-25.

THE CINCINNATI BICKFORD TOOL CO.
OAKLEY · CINCINNATI · OHIO · U. S. A.

Brake Shoe & Foundry Co., Chicago Heights, Ill., has published a 64-page illustrated booklet entitled "Amsco Manganese Steel, the Toughest Steel Known." It discusses the company's facilities for producing the steel and includes examples of many interesting applications of this material.

PLASTICS Plastics Dept., E. I. du Pont de Nemours & Co., 626 Schuyler Ave., Arlington, N. J., has begun publication of an illustrated bulletin, "DuPont Plastics," designed to present news of the latest developments and applications of plastics.

SCREW MACHINES A booklet published by Brown & Sharpe Mfg. Co., Providence, R. I., provides 32 pages of illustrations, specifications and other information on its line of wire feed screw machines.

SOLENOIDS Type CR9503 a.c. and d.c. solenoids are described in Leaflet No. GEA-2080, offered by the General Electric Co., Schenectady, N. Y.

STAINLESS STEEL A handy 16-page stock list, No. SC-100, issued by the Crucible Steel Co. of America, 405 Lexington Ave., New York, N. Y., gives complete specifications of "Rezistal" sheets, bars and welding rods.

TABLE CHUCK Features and uses of the Hartford "Super-Spacer," an indexing chuck for use on many types of machine tool tables, are discussed and illustrated in a 4-page folder offered by the Hartford Special Machinery Co., Hartford, Conn.

THREADING "Detroit Ground," a 140-page catalog published by the Detroit Tap & Tool Co., 8400 Butler St., Detroit, Mich., gives comprehensive data covering an extensive line of threading equipment and includes a section on precision grinding of threaded production parts.

THRUST BEARINGS Features and specifications of an extensive line of ball and roller thrust bearings are included in a 16-page illustrated catalog, No. 16, published by the Gwilliam Co., 360 Furman St., Brooklyn, N. Y.

WELDING A 24-page illustrated catalog, No. 334, showing an extensive line of oxy-acetylene and oxy-hydrogen welding, cutting, brazing and lead-burning equipment and accessories has been issued by Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.

WHEEL DRESSER The "Vinco" attachment for dressing any angle tangent to a radius is described in a folder issued by the Vinco Tool Co., 7350 Central Ave., Detroit, Mich.

MORE PRECISION WORK

With Rivett Spring Tempered COLLETS

A set of spring tempered collets and draw-in attachment can improve the production and precision work on any engine lathe. This quick, accurate method of chucking bar stock and odd shaped parts is a guarantee for **MORE PRECISION WORK.**

The collet attachment and any style collets can be furnished from stock. Write for bulletin 100-b and print to be filled in with the required spindle dimensions.

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NEW BOOKS

THE ABC OF AVIATION—*By Lieut.-Col. Victor W. Pagé, U. S. Air Corps Reserve. 418 pages, 5 x 7¾ in. Cloth board binding. Enlarged and revised edition. Indexed and illustrated. Published by the Norman W. Henley Publishing Company, 2 W. 45th St., New York, N. Y.*

Written especially for beginners, this instruction manual is intended as an elementary introduction to the study of aviation by students, mechanics and others wishing a groundwork in the basic principles of aviation. It provides a simplified exposition of all types of aircraft, with much information concerning their construction and operation. Also discussed are recent developments in airplanes and engines, inspection and trouble shooting, instruments used for blind flight, and ordinary and acrobatic flying maneuvers.

SEEN and HEARD

JOHN R. GODFREY

Rest Stops

Twenty-five years ago progressive office managers pepped up the clerical force by short rests and mild exercises with windows open, even in cold weather. It was an application of the rest period idea that Fred Taylor inaugurated early in his scientific management days. He found that frequent short rests enabled a husky laborer to handle more pig iron in a day.

Air conditioning in offices seems to have taken the place of open windows and exercises; and some sort of machinery has replaced the pig iron toter with conveyors of various kinds. But the human element still remains the greatest problem of management.

Painting Them Anyhow

A recent visit to a job shop in one of the southern states found the two owners going over their books. "Trying to see whether we made any money, or how much we lost" was the explanation. The interesting thing was that they were giving all the machine tools a good coat of gray paint, regardless of their age—and some were plenty old. They may have figured that if they folded up, the machines would bring more with a good coat of paint.

Cost Economies In Gas Cutting

By G. M. DEMING

In order to determine the approximate aggregate cost of producing any particular steel shape by oxygen cutting, it first is necessary to have a clear knowledge of detail costs for producing cut shapes. These costs obviously include the cost of the oxygen used in the cutting jet, the cost of the fuel gas and oxygen used in the preheating flames, labor cost and overhead cost. Frequently, the cost of the steel in the shape-cut article and the scrap-depreciation cost, that is the economic loss involved in the steel scrap, are overlooked. Computations of aggregate costs usually will be significant only when the latter two items are included, since they are the dominant costs except for very small articles.

For all but thin articles, the cost of the cutting operation, as such, usually is so small that a rough but frequently used approximation of the aggregate cost may be obtained merely by adding the cost of the steel actually utilized to the loss involved in the scrap. Actual cutting costs will vary by ±50 per cent as a result of varying degrees of the efficiency of utilization of the oxygen cutting process, which is typical of present practice. It is, therefore, useful to remember that for a great variety of shapes the typical cutting costs are on the order of ±15 per cent of the steel costs.

More exactly, the aggregate cost of oxygen cutting may be obtained from the following formula:

$$C=SA+X\,(S-K)+ZL$$

Where:

C=the aggregate cost of the piece
S=unit cost of the steel used
A=weight of the oxygen-cut article
K=unit value of the scrap
X=weight of scrap produced
Z=cost of the oxygen-cutting process per unit of cut length
L=length of the cut contour

Until each major item of cost is fully analyzed, understood and reduced to a practical minimum, excessive emphasis upon the minor

NEED STEEL?

Ryerson Has Thousands of Tons In Stock for Immediate Shipment

Especially now, when steel deliveries are somewhat uncertain, it is good to know that Ryerson has large and diversified stocks of certified steel on hand for quick shipment.

Thousands of manufacturers in every line are daily drawing on these stocks to meet current requirements. Ryerson immediate warehouse shipment forms cheap insurance for the protection of your production schedules.

Check up and play safe on your steel requirements. Ten large Ryerson plants, carrying more than 10,000 kinds, shapes, and sizes of steel and allied products, stand ready to meet both your regular and emergency needs—and you will get Ryerson certified quality at no extra cost. If you do not have the current Ryerson Stock List, we shall be glad to send a copy.

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RYERSON CERTIFIED STEELS

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items may even detract from the greatest possibilities in cost reduction. But, it is rather unreasonable for one to become solely concerned over some saving which presumably may be effected by changing the preheat fuel gas, which usually amounts to less than three per cent of the total cost, while neglecting such things as the scrap depreciation and the labor cost, both of which amount to many times this value.

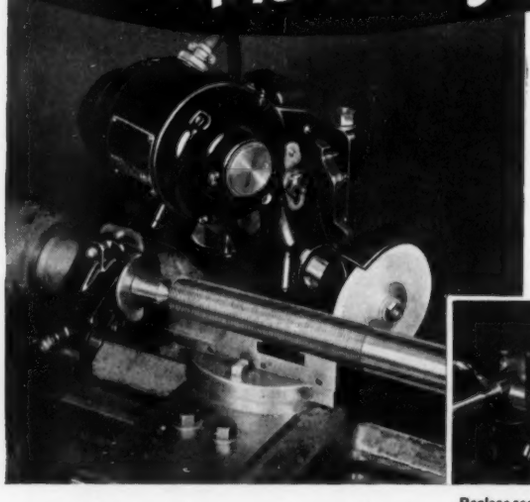
Of the various detail costs, the one which is most likely to vary widely in practice is the cost of the steel used to make the oxygen-cut article. For parts of similar shape, the area and, therefore, the weight of the material vary as the square of the linear dimensions, whereas the perimeter varies directly as the linear dimension. Hence, the relative importance of the steel utilization cost of a circular part increases as the square of the diameter while the cost of the oxygen cutting process increases directly as the diameter. For long narrow pieces, the area-length ratio will tend to be low and, consequently, cutting costs greater and the steel costs relatively less important. Nevertheless for larger shapes in general the steel costs become so important that every effort should be made in the design of large articles to reduce the area, and particularly the weight of the article. When a judicious combination of oxygen cutting and welding is employed many interesting things frequently may be accomplished.

The term "scrap depreciation" is used to signify the difference between the original value and the salvage value of the scrap produced in cutting. The scrap can and should be used as far as possible for the gas cutting of smaller parts. On the other hand, the tendency for the shape and size of parts to be ill-adapted to the standard size of material which usually must be employed tends greatly to stimulate the production of much scrap. Consequently, the scrap depreciation ordinarily is one of the principal items in the cost of the cutting operation. It is very important, therefore, where a great variety of parts are being cut that every effort be made to utilize the scrap material from one part for smaller parts.

Of course, labor costs will vary considerably, but they usually are more important than the cost of the cutting oxygen, particularly for the lighter thicknesses of stock. This suggests that for the lighter gages it may even be advisable to increase the speed of cutting by the use of larger tips and higher operating pressures, even though such procedure would tend to increase oxygen costs. Such procedure requires careful investigation of the cutting variables in order to insure that such a procedure is justified by an actual reduction in the over-all cutting cost. Moreover, cuts of exceedingly poor quality may be obtained as the result of effort to increase the speed of cutting, with the result that subsequent finishing operations add more to the cost of the finished article than was saved by the increased speed of cutting.

A good means of reducing the labor cost where the volume of standardized designs justifies it is through the use of multiple-torch cutting machines. Just how much the production capacity of a machine may be increased and the labor cost per item decreased will depend upon the material handling facilities and the manner in which the work is organized. While the use of multiple-torch cutting will by no means reduce the labor cost in direct proportion to the number of torches, it will effect very substantial savings. Stack cutting, when feasible, will also reduce labor costs. For moder-

NOW.. GRIND THREADS at a FRACTION of Former Cost

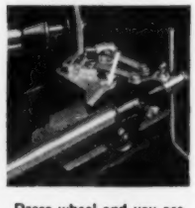


New ATTACHMENT For DUMORE No. 5 Precision Grinder Revolutionizes Thread Grinding

Replace regular mounting post with special one.

Set up grinder by easy-to-follow instructions.

Clamp the wheel dressing attachment to lathe.



Dress wheel and you are ready to grind threads.

Quickly, easily convert one of your lathes into a precision machine for grinding threads. An amazing new attachment for a Dumore No. 5 Grinder does the trick . . . costs but a small fraction of the usual investment for special thread grinding machines . . . requires no installation expense . . . no extra power . . . ties up no large amount of capital. Can be set up and operated by anyone who can chase a thread. Ask your Dumore distributor for complete information and an actual demonstration in your plant. No obligation.

EASY TO SET UP AND OPERATE

A few simple rules to follow and the Dumore attachment converts a lathe and your Dumore No. 5 Grinder into a thread grinding machine.

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DUMORE

PRECISION GRINDERS

ate quantity production of lighter gage shapes, it should not be overlooked as a possibility.

Since overhead cost usually is calculated as a percentage of labor costs, it is important to recognize (1) that it is a function of the duration of the cutting process, (2) that its importance is almost as great, in most cases, as the labor cost, and (3) that what has been said about appropriate means for reducing the labor cost is largely applicable to the problem of reducing overhead costs. The direct effect of the interest on the capital investment in cutting equipment and the cost of maintenance upon the overhead are, generally speaking, insignificant. Consequently, cost reduction efforts through the use of proper material handling equipment and more effective cutting machines gain particular significance when it is realized that economies in this direction may be obtained with an almost inappreciable increase in overhead cost.

Cut quality is a matter of primary importance when considering economies of machine gas cutting. This is because a detailed examination of this subject teaches just what standards of quality may be obtained through the use of more precise methods or cutting machines, and what the resulting saving may be in the cost or the increased value of the finished article. It should be understood that with carefully selected and intelligently maintained cutting equipment and a painstaking evaluation of the cutting variables, almost unbelievably precise cuts may be executed dependably. When full advantage is taken of this fact, subsequent machining operations frequently can be avoided.

Abstracted from a paper on the "Economics of Machine Gas Cutting" delivered by G. M. Deming, research engineer, Air Reduction Sales Company, presented at the 39th annual convention of the International Acetylene Association, Houston, Texas, March 8–10, 1939.

Commercially Noiseless

By H. M. LANE

Many years ago, before Andrew Carnegie gave the engineering societies the home building at 29 West 39th Street in New York, the A.S.M.E. had an old dwelling of the brownstone front vintage at 12 West 29th Street. In the rear they built an auditorium large enough for their needs at the time. The first floor contained the executive offices, and on the second floor the secretary, Dr. Hutton, had his office. Above were a number of sleeping rooms which were rented to out-of-town members for short stops.

In the second room from the front, on the ground floor was an open fireplace, and many of us have spent pleasant evenings before the fire, telling stories or experiences. One night in such a group were present Mr. Dixon, president of the Dixon Works, Scranton, Pennsylvania, and John Fritz, of the Bethlehem Steel Company, Bethlehem, Pennsylvania.

Uncle John, as we all called him, said, "Mr. Dixon, what brings you to the big city?"

The reply was, "Tomorrow the Cable Railways are taking bids on a new engine for one of their power houses, and I do not know what to do with one clause in the requirements. They say the engine must be noiseless. Now you know that even a Corliss engine makes some noise."

Uncle John spoke up and said, "This engine shall be commercially noiseless."

The words were inserted in the bid; all the other bidders had said nothing about noise, and so the board gave Mr. Dixon the contract.

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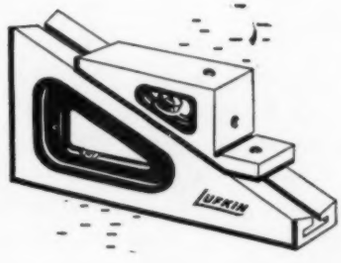

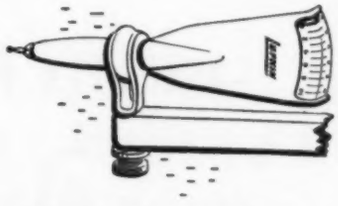

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